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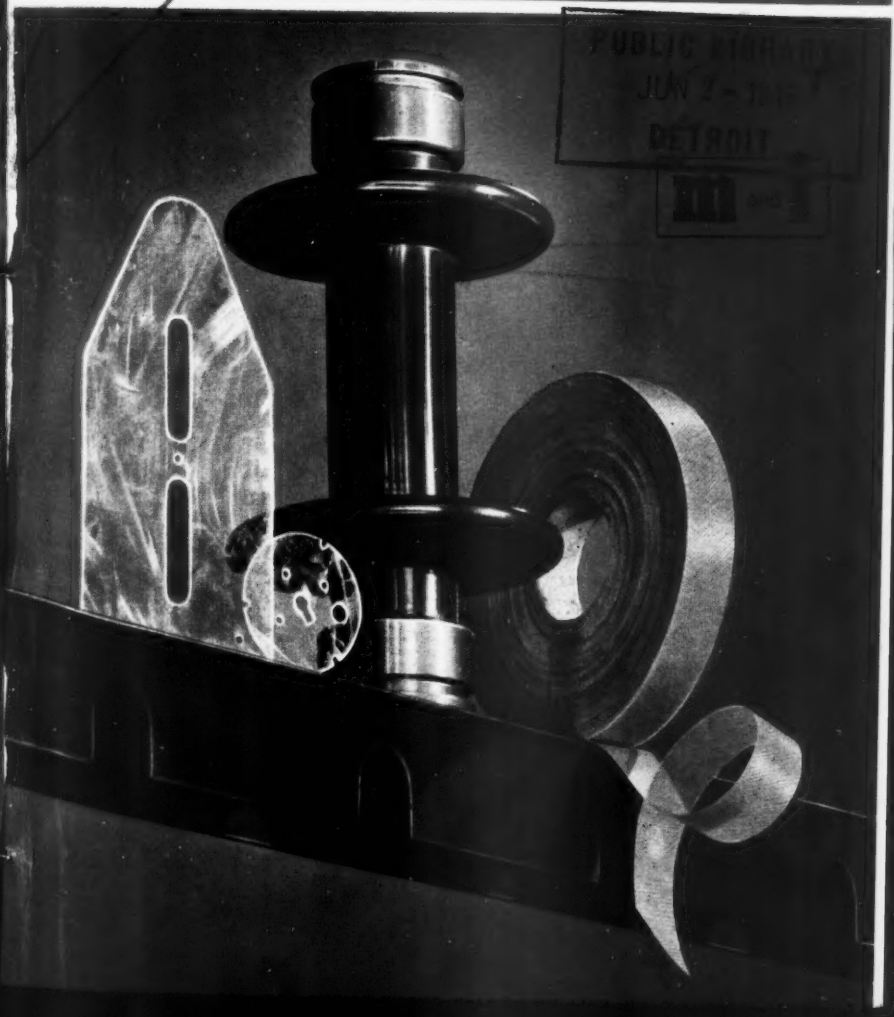

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BEXOID
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MOULDING POWDER

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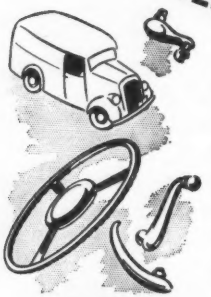

Bexoid Moulding Powder (cellulose acetate) lends itself to numerous applications—in the motor, shipping, aircraft, electrical and many other industries. As the standard all-round injection material, it is adaptable to all types of injection moulding machines and is available in varying grades, in five degrees of flow. Immediate delivery can now be arranged.

The BX Technical Development Service is always glad to offer help and advice on problems connected with the use of thermo-plastics. No obligation is incurred in the use of this service.

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Our plastic and ebonite moulding service is at present restricted to export and essential products. Our productions include parts for batteries, radio sets, water meters and sanitary ware for *EXPORT* and mouldings for textile machinery, miners' lamps and electrical equipment for *ESSENTIAL* industries. If you are a manufacturer concerned with the '*two E's*', our service — the design, tooling and quantity production of high quality mouldings — is at your disposal.

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Designed to meet the demand by production engineers for a more compact Heat Generator, the Airmec embodies latest electronic practice and is available in 5 kW and 2 kW models, both ideally suitable for dielectric heating of plastics. Suitable work boxes for plastic pre-heating are available for mounting in cabinet. They are the most compact units of their power rating.

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Full details on request.

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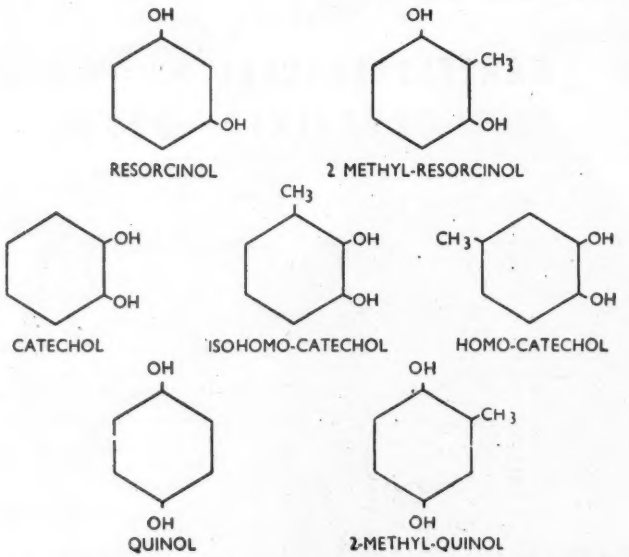
DIHYDRIC PHENOLS from the COALITE process



UNTIL now, industrial requirements of *CATECHOL*, *RESORCINOL* and *QUINOL* have been met by the synthetic products, whilst their homologues have been unknown outside a few research laboratories. It has now been found that the low temperature carbonisation of coal by the "COALITE" Process yields by-products rich in all the dihydric phenols depicted above, and plant is under construction for their isolation and purification on a large scale.

AT PRESENT only small laboratory samples of these products are available, but users of catechol, resorcinol, and quinol are invited to write to us concerning the quantities and qualities that will be available.

MANUFACTURERS and RESEARCH LABORATORIES interested in investigating possible uses of the hitherto unavailable *METHYL-CATECHOLS*, *METHYL-RESORCINOL* and *METHYL-QUINOL* are invited to write for small samples.

PLANT will be installed for the preparation of all these valuable phenols, in the pure state, for the manufacturers of fine chemicals. Crude fractions of these, suitable for such technical processes as resorcinol-glue manufacture, will also be available.

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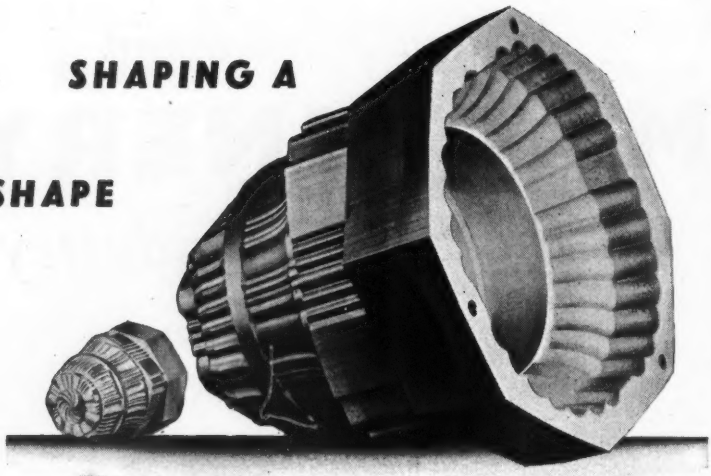
477/P.156

SHAPING A SHAPE



We don't expect anyone to ask us for a mould of the shape shown here, but we do expect, and get, and carry out orders for tools quite as intricate in design. This demonstrates what can be accomplished with a shape lathe . . . you see it just as it left the lathe, before finishing. We did not invent the shape lathe on which this was turned, but we have added to it refinements you will not meet elsewhere. Some of our other machines we have created, because nothing existed to do the job, and this has helped to make us the most highly specialised and self-contained plastic mould-making unit in the industry. We leave nothing to chance. No phase of the work suffers from improvisation. Everything is meticulously tested and inspected at every stage. Our expert after-sales advisory service provides technical assistance for the moulder and ensures a long life and satisfactory performance for all our products.

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SIMPLE IN OPERATION
One lever controls both opening and closing movements of the press.

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A single connection to the electrical supply and the press is ready for operation.

The **TURNER PLASTICS PRESS**

TURNER MANUFACTURING CO., LTD., WULFRUNA WORKS, VILLIERS ST., WOLVERHAMPTON

In Cellulose Acetate...

it's an invitation to buy

Crystal-clear cellulose acetate is now freely available for the manufacture of elegant containers or toys. This durable yet dainty material is quickly and easily moulded into superior containers of any shape or size which display products in the most inviting way. Toys made from this versatile substance are safe and ideal for youngsters.

Cellulose acetate can be tinted, embossed, printed or left with its natural sparkle.

★ *We welcome your enquiries for Cellulose Acetate which we make in rolls and sheets in all thicknesses from .001 to .010 inches.*

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Methyl Isobutyl Ketone

$CH_3 . CO . CH_2 . CH . (CH_3)_2$

● METHYL ISOBUTYL KETONE is a colourless liquid with a characteristic odour, possessing a medium boiling point, a lower rate of evaporation than Methyl Ethyl Ketone and good solvent power. It is inert towards metals and does not hydrolyse to acidic products which might give rise to corrosion problems.

METHYL ISOBUTYL KETONE is an excellent solvent for cellulose nitrate, ethyl cellulose, benzyl cellulose and for many natural and synthetic resins, including phenolic, alkyd, vinyl copolymers and methyl methacrylate polymers. It is thus a valuable medium boiling solvent for cellulose and highly polymerised vinyl type resin lacquers.

Shell METHYL ISOBUTYL KETONE is manufactured to a high degree of purity and conforms to the following specification :

PURITY	Minimum 99% by weight.
SPECIFIC GRAVITY @ 20/20°C.	0.800—0.804.
DISTILLATION RANGE (A.S.T.M. D.268).	Below 114°C.—none. Above 117°C.—none.

When the new Thornton Plant comes " on stream," Shell METHYL ISOBUTYL KETONE will be obtainable in quantity. In the meantime, samples of this very promising aid in plastic processing are immediately available for experiment and evaluation.

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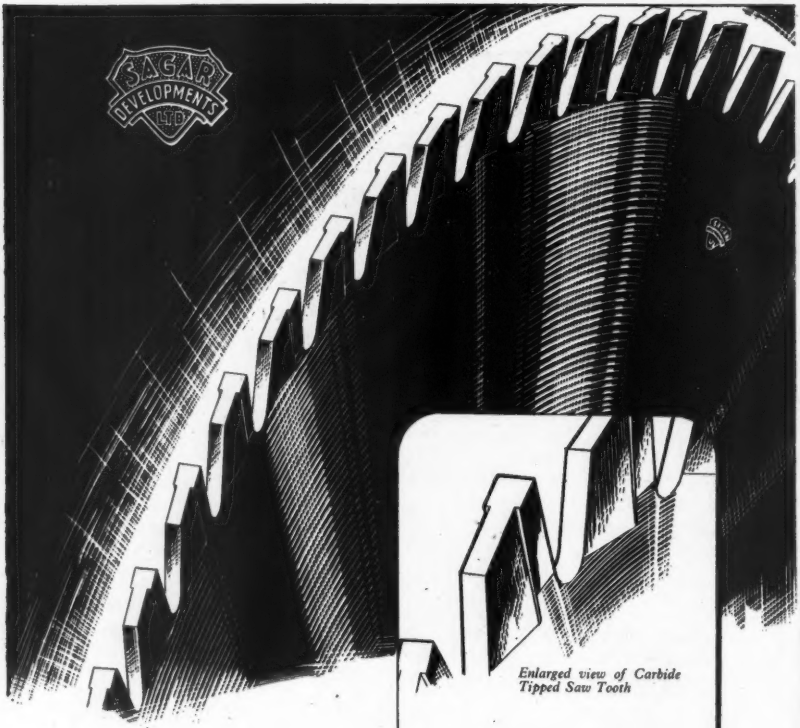

Enlarged view of Carbide Tipped Saw Tooth

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The cutting of plastic and plastic bonded materials causes rapid blunting of ordinary cutting edges and calls for large stocks of tools. Sagar carbide tipped saws, knives and solid cutters banish the abrasion bogey, last longer between sharpenings, cut more quickly with a fine finish and waste less material. Plastic sheeting is kept safe from shattering and the keen cutting maintains the necessary coolness in thermo-plastics. We shall be glad to demonstrate how Sagar Carbide Tipped Tools can speed production and cut costs.

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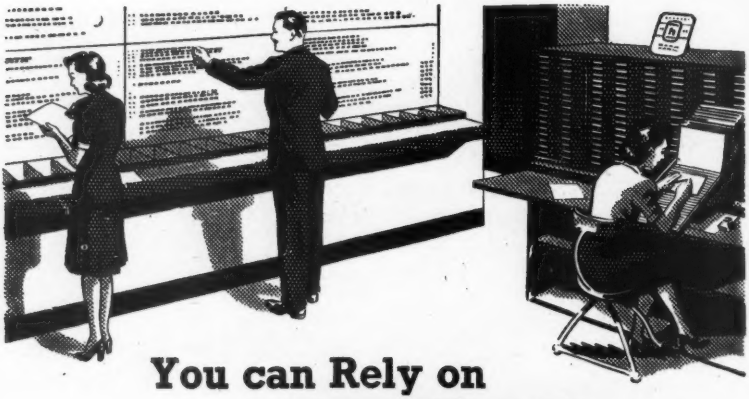

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"CELLOMOLD" *Cellulose Acetate Moulding Powders*
"EPOK" *Resins*
"ROCKITE" *Phenolic Moulding Powders*

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SYNTHETIC RUBBER

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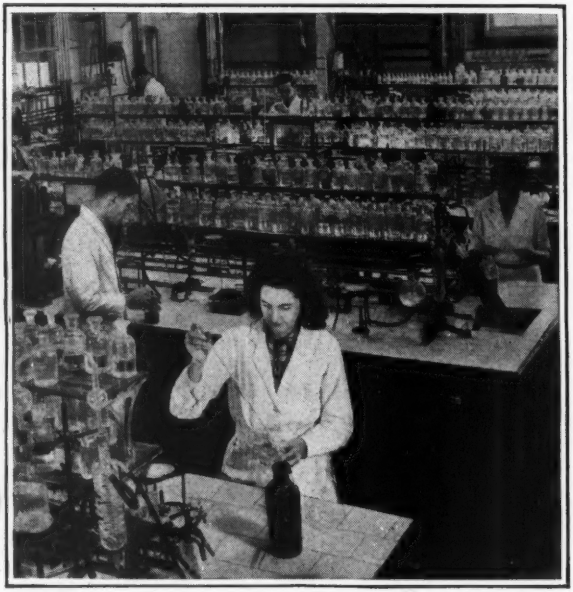

Ether-M&B
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In all processes requiring a B.P. grade of Chloroform or a B.P. or B.S.S.579 grade of Ether the M&B *products may be relied on for consistently satisfactory results.*

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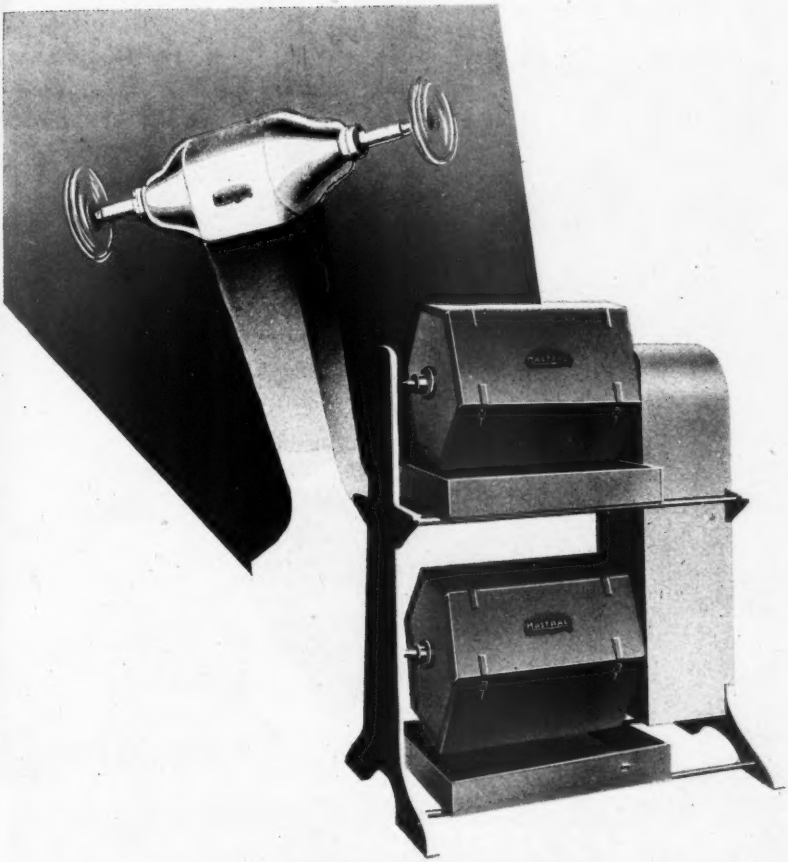

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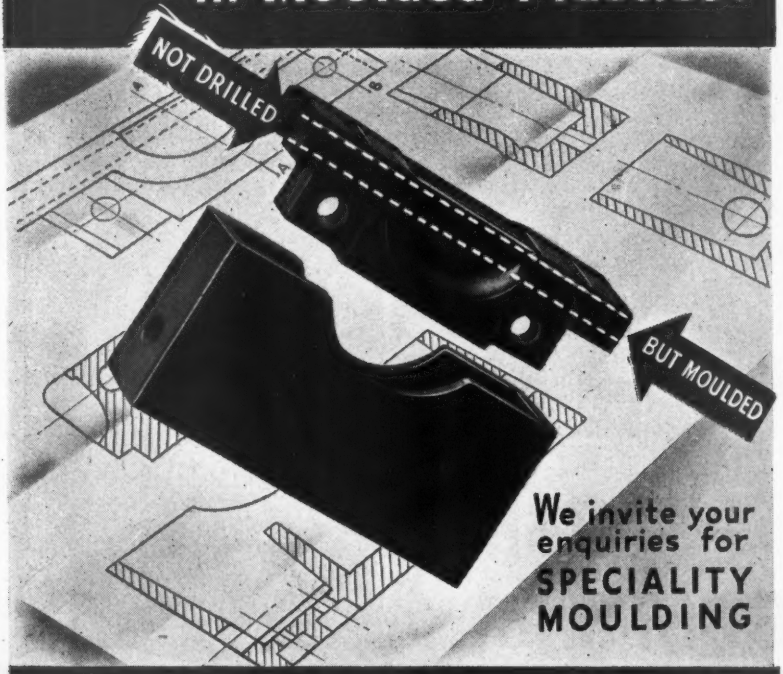

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150 PEARL & CLEAR	2 . 9	3 . 9	2 . 5	3 . 5
200 CLEAR	4 . 6	6 . 3	4 . 0	5 . 7
200 PEARL	5 . 0	6 . 11	4 . 6	6 . 3
300 CLEAR	8 . 0	—★	7 . 6	—★
300 PEARL	9 . 0	—★	8 . 6	—★
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★ **Not subject to purchase tax**

Announcement of The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2

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Fothergill & Harvey *introduce*

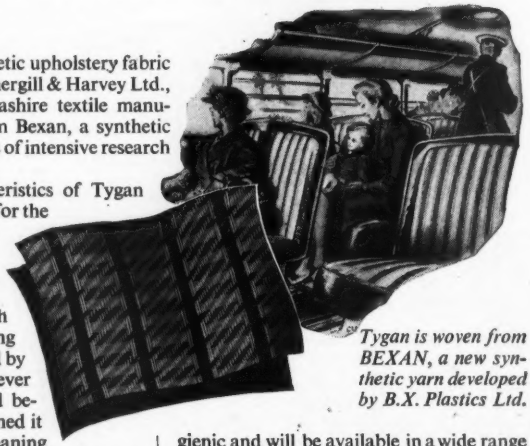
Tygan

a new woven upholstery fabric

TOUGH · WASHABLE · HYGIENIC
MOTHPROOF · FAST TO LIGHT

Tygan is a new synthetic upholstery fabric woven exclusively by Fothergill & Harvey Ltd., the old-established Lancashire textile manufacturers. It is made from Bexan, a synthetic yarn developed after years of intensive research by B.X. Plastics Ltd.

The unique characteristics of Tygan make it specially suitable for the upholstery of the seats in public transport vehicles. Tygan has outstanding resilience, toughness and abrasion resistance, which ensure excellent wearing qualities. It can be cleaned by sponging, and so need never look travel stained. And because it is so easily cleaned it speeds up the work of cleaning gangs. Tygan is fast to light, is mothproof and will not mould or rot. It is exceptionally resistant to acids, alkalis, alcohol and many other organic solvents. It has a negligible water absorption and is therefore never damp. Tygan upholsters well, is smart and hygienic and will be available in a wide range of pleasing colours and designs.

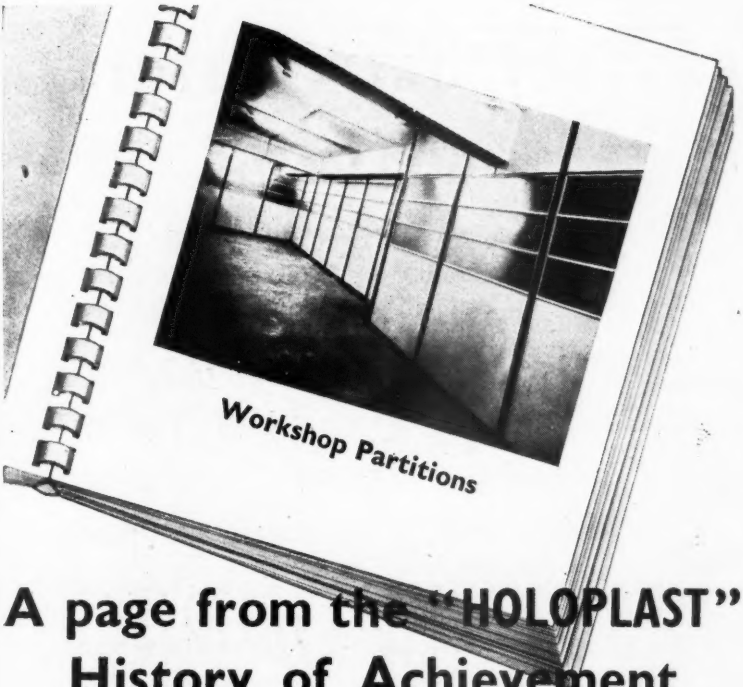


Tygan is woven from BEXAN, a new synthetic yarn developed by B.X. Plastics Ltd.

Tygan undergoes the same rigorous testing as other Tyga Textiles in the laboratories of Fothergill & Harvey Ltd. This is an assurance of the consistent high quality and serviceability of Tygan, which conforms in every respect to the highest standards of Lancashire woven productions.

● This is one of the advertisements for Tygan appearing in the Transport Trade Press.

Write for illustrated folder with patterns, quoting reference Z1 to FOTHERGILL & HARVEY LTD., Thirty-seven Peter Street, Manchester 2



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Thus are "outsiders" debarred from NESTORITE.

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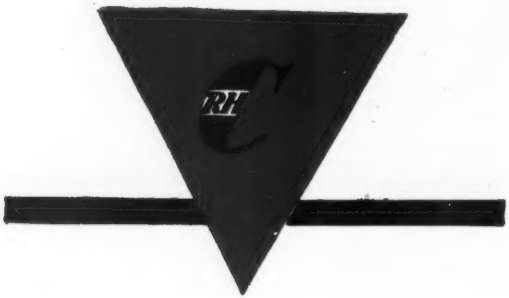

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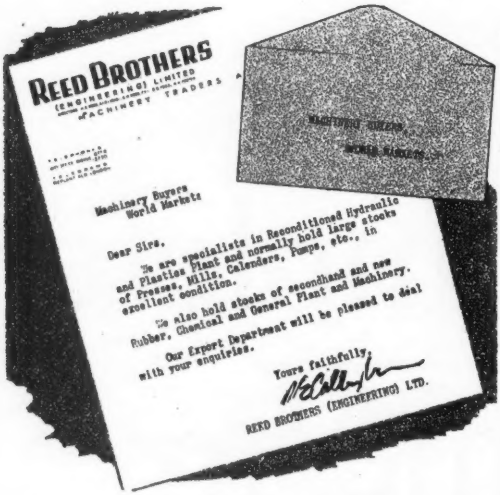
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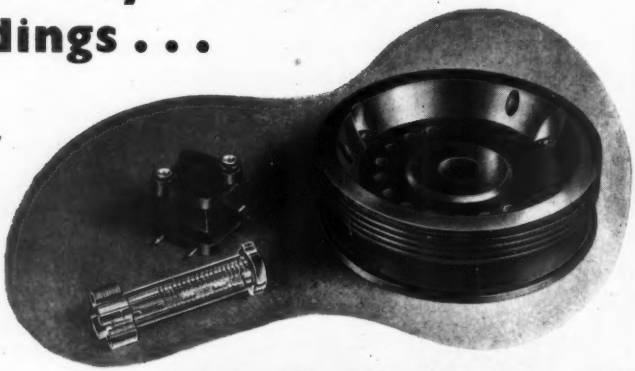

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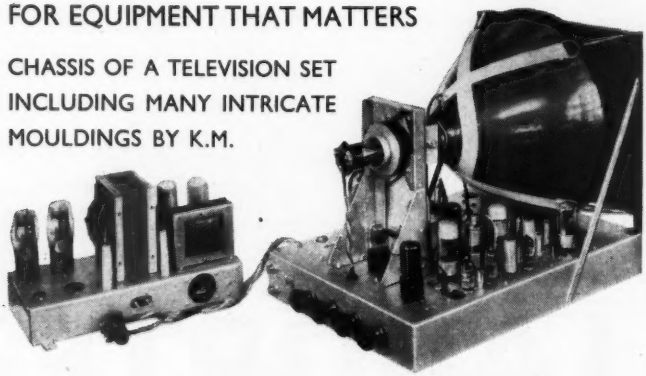

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Vol. XII. No. 132 MAY, 1948

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

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NOTICES

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EDITORIALS

Mature Lady with Medals

THIS issue, which goes to press during the last week of the British Industries Fair, is replete with a very wide selection of photographs of the stands in the Plastics Section. We hold over a fuller description of the individual exhibits and of certain specialities until the June issue, when the tumult will have subsided.

It has certainly been an exciting time, for while we were assured that there were more exhibitors than ever, the number of visitors, foreign and native, has surpassed all records so far as the Plastics Section is concerned.

Last year's stands appeared then to have surpassed all previous ones in beauty and ingenuity of presentation. This year's has been no whit behind it and has even been strengthened by the advent of still newer raw materials, which, strangely enough, appear with unfailing regularity and an ever-widening production of new and intriguing finished goods.

Much of the attraction obviously lies in the galaxy of colour that is always presented, but perhaps of greater fascination, on closer examination, is the bewildering variety of production from what we designate as plastics. No other individual exhibit in any other industry can show what can be seen at any representative moulder's stand—textile bobbins and radio cabinets, electric switchgear covers and toys, shirt buttons and motorcar equipment, ships' furnishings and bottle closures, and accumulator boxes and lighting equipment.

Nor can any industry other than the chemical industry, of which we are part, show such a variety of raw materials to make all the above and a host of other products, ranging from synthetic glues for barrel, ski, aircraft and naval construction to thermoplastics for making belts, floor-cloth, dress decorations, furniture coverings, windows, toys, cups and saucers, cable coverings, radar equipment insulation, water and beer pipes, television lenses, and almost anything else you could wish for, such as tool handles, lampshades or acid bottles.

The Plastics Section has more attraction in it than mere colour and variety. The public are slowly but surely recognizing, with the ubiquity and rising number and standards of raw materials and finished goods, that plastics are not temporary substitutes for the traditional raw materials, but a new, permanent addition to the flexibility of our national equipment.

So much we learned at our own "Plastics," stand, where trade inquiries and the public urgently put us questions which they never attempted 10 years ago. Then, most merely stared and wondered. To-day there is active interest which makes everything worth while.

More Raw Materials

PERHAPS one of the most heartening aspects of our industrial life, so far as plastics are concerned, is the determination to increase production of our raw materials.

During the past 10 years we have pointed out the necessity of introducing the "chemicals from petroleum" methods, so well known in the United States and mooted here so strongly by Manchester Oil Refinery, Ltd., and others.

Now is the summer of our content, for the latest news in the development of I.C.I.'s new factory at Wilton, in North Yorkshire, finally sets the seal on any doubts regarding the use of petroleum as an important, if not major, source of our materials. This enormous production unit will also "crack" petroleum to produce the simple "unsaturated" hydro-

carbons which serve as basis for very many industrial chemicals, a large number of which cannot be made by any stretch of the economic imagination from coal. Many others can normally be so produced, but so great has been the rise in cost of coal, and so appallingly low the output in this country under conditions of ever-increasing demands, that many methods of chemical production have been re-orientated.

We are now watching, because of social upheavals, a staggering change in what is now one of our greatest industries and which since the early 19th century has been based on coal.

At Wilton, two of the important products will be the unsaturated gases, ethylene and propylene. Ethylene will be polymerized to polythene, the outstanding electrical properties of which are well known and for which a large market is foreseen. Propylene will be worked up via isopropyl alcohol into acetone, a solvent and an intermediate for which there are demands both inside and outside the company. Both ethylene and propylene can be processed into intermediates for the manufacture of high-grade detergents, which are of particular interest in the world to-day when fats are scarce.

The Wilton works are near to Billingham, where organic chemicals are already made on a very large scale. At Billingham the basic raw material is coal, and much of it is used in the form of coke and creosote. The two major organic products are petrol and methyl alcohol. Billingham and Wilton in this matter of organic chemicals will be indispensable one to the other. Three examples can be quoted: first, plant is available at Billingham, which, with little adaptation, will be suitable for the conversion of Wilton propylene into isopropanol; second, the operation of the Wilton cracker gives petrol as a by-product, and this petrol can be handled advantageously at Billingham along with their petrol obtained by the hydrogenation of coal; third, the methane hydrogen fraction from the Wilton cracker gases will find a ready use at Billingham to replace part of the coke used there to make hydrogen for ammonia, methanol and petrol production.

The interdependence of activities at Billingham and Wilton is well demonstrated in the manufacture of "Perspex." "Perspex" was first made at Billingham, and is now also produced in several other I.C.I. factories. The demand for this material is such that it is now necessary to build a new plant at Wilton with the most up-to-date equipment.

The above outline deals only with the first step in the development of the Wilton works. These works will accommodate many of the plants for new products from I.C.I.'s research laboratories as well as extensions of older manufactures, for which space in factories is now more difficult to find.

The whole "set-up" of the new developments that existed in embryo only three or four years ago will provide a much firmer basis for the whole chemical industry, of which the plastics industry is so important a part.

State Invention Development

PROTECTION of British inventions will be advanced by the National Research Development Corporation, the creation of which is proposed in the Development of Inventions Bill now before Parliament. The new corporation will have the power to develop a wide range of patents, especially those of national importance, to erect pilot plants for their technical examination, and to licence inventions to industry.

The new step is in many ways a timely and satisfactory one, for the history of British invention is both great and disappointing.

Great because the Industrial Revolution, which began in this country, saw a spate of scientific discovery, especially in engineering and chemistry, that at times was the envy and wonder of the world.

Disappointing because, on the whole,

there was, and still is, a disinclination by statesmen, financiers and, therefore, the public in general, to regard science, especially chemistry, with anything but suspicion. Mainly due to ignorance and the fear of not understanding industries based on science, and because of the growth of trade pure and simple, and of the riches gained through it, and the so-called invisible exports, there was no desire to help inventions from which results could be obtained only after years of investigation.

The general attitude in the country of "Has so-and-so bought it (or tried it)?" has killed many a project or discovery.

So, to-day, research and invention is the exception and not an automatic rule and the tendency appears to be to prefer new manufactures already developed abroad and to pay licences for them.

The propaganda sent out by the Government regarding the action of foreign countries in "stealing" British ideas is not altogether fair. It has much basis, however, because of the appalling patent laws that exist, especially from an international point of view.

It is true, for example, that synthetic dyestuffs were discovered here by Perkins in 1857 and, indeed, manufactured here. The real implication was completely understood by the Germans, who then created a dyestuffs industry which became a world monopoly until 1914.

The production of Vitamin D was discovered in Britain, but patented and exploited in the U.S.A., following, we believe, publication of the discovery in British scientific journals. We have paid £7,000,000 in licences for the privilege of manufacturing here. The blame primarily lies elsewhere than with the U.S.A.

The examples could be multiplied many times and we could also cite the completely immoral methods of industrial Japan, who could invent, let us say, Scotch whisky and sell it to India or the South Sea Islands, complete with exact replicas of bottles, trade marks and addresses of Scottish distillers.

Under other conditions we should have regarded the foundation of such a State Corporation with the greatest of distrust and suspicion, for the Government should improve the patent laws and leave the rest to private enterprise.

It is not the way to industrial salvation, but it may awaken the country to the value of British science. We therefore welcome it.

Out!—of the Mouths of Babes

ON going to press we learn from a reader that he has seen and examined a baby's comforter or "teat" made of polyvinyl chloride and wants to know what we are going to do about it.

Our first reaction was disbelief that anybody knowing the constitution and make-up of ordinary polyvinyl chloride would attempt such production, and that the reader had mistaken pure rubber for p.v.c. Our second reaction, remembering that babies' knickers, worn close to the skin have definitely been manufactured, reminded us that anybody can get hold of p.v.c. and do what he likes with it.

If some individual with bright ideas has really considered this material suitable for the purpose indicated, let us remind him of the following facts:—

We do not consider even *pure* polyvinyl chloride suitable. The plastic used for making sheets and for moulding often contains a small addition of lead stearate or other lead salt. Furthermore, in order that the material can be worked on a machine, it also contains from 5 to 20 per cent. of plasticizers, chemicals which must be considered noxious or, at least, suspect for a child when the object is held in the mouth for many hours during each day for as long as a year or more. Certain plasticizers, indeed, must be considered especially dangerous.

What can be done about all this? A black-listing of such manufacturers is quite impossible, owing to the ease of obtaining p.v.c. from agents. Is it not time that the matter was examined by an authority, so that by some means or other the buyer may be warned not to produce goods of this type?

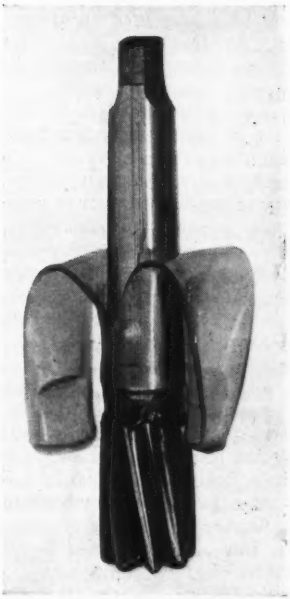
Protective Packaging for Small Tools

AN effective packaging medium to give adequate protection to delicate precision tools against such factors as corrosion has for long been sought by the tool manufacturers. The Birmingham Tool and Gauge Co., Ltd., of Soho Hill, Handsworth, Birmingham, 19, has now taken a practical step in this direction. Such products as milling cutters, reamers, form tools, boring bars, tool holders, etc., which this company manufactures, will, in future, be coated with a tough, transparent plastic material—"Safepak"—before being dispatched to customers.

This new coating is claimed to provide complete protection for metal parts against all forms of corrosion, damage or abrasion, mishandling, etc., during transit and storage periods, even under extreme conditions. Gauges and tools when encased in the coating are visible to the customer, thus enabling any marking to be easily read. They can be handled freely, without the danger of corrosion from the moisture of the fingers.

Due to its high impact resistance, the new coating affords protection against damage, which might be caused by accidental dropping. It can be removed very easily by a simple stripping operation, revealing the tool or other metal part ready for immediate use, and already lubricated with a film of oil which is automatically exuded from the plastic coating. The accompanying illustration shows the coating in course of being stripped from a machine tool.

Basically, the "Safepak" technique appears to be similar in principle to that of the ethyl cellulose plastic coating, "Stripcoat," which was developed by the Dow Chemical Co., in the United States, during the war. The material used is a cellulose plastic (in solution) which is applied by the hot-dip method and cooled immediately by the atmosphere, thereby enveloping the tool in a tough skin through which neither moisture nor air can penetrate. The thickness of the coating produced is determined by the heat-absorbing properties of the metal; generally it is from 0.05 to 0.07 in., which is a thickness found adequate for most practical purposes. If a heavier coating is desired, the metal is dipped twice.



The coating is sufficiently resilient to allow for contraction or expansion of the metal part due to temperature changes. Products of the Birmingham Tool and Gauge Co., Ltd., encased in this new protective medium were exhibited at the Gauge and Tool Exhibition recently held in London.

A similar material is manufactured by Glostics, Ltd., of Gloucester, under the name of "Gloscoat," for which J. M. Steel and Co., Ltd., of London, have been appointed sole distributors in the United Kingdom.

PAPER SALVAGE.—The need for collecting wastepaper for re-use is still very urgent!

The Paper Industry Looks at Plastics

PLASTICS are used in paper manufacture for three main purposes. First, to improve wet strength; secondly, to impart special properties, such as grease or water resistance; thirdly, to provide an attractive surface finish.

Regarding improvement of wet strength, it is well known that considerable progress has been made possible by the use of urea-formaldehyde resins, melamine resins and polyvinyl alcohol, the last assuming particular importance in manufacture of paper towelling. Urea formaldehyde, and specially modified urea - formaldehyde resins, are freely soluble in water and available as 50 per cent solutions suitable for addition to the paper stock at any desired stage between the beater and the head box. Melamine resins give better results than the urea type. War experience showed that maps printed on melamine-treated paper were not only highly resistant to water, but also unaffected by tropical humidity, oil, grease and petrol, and by repeated folding. Blueprints, instruction booklets, lens-wiping tissues and other paper items have also been made practically indestructible by treatment with melamine resins.

Owing to the fact that melamine can endow paper with exceptionally high wet strength, and also bring about important improvements in dry strength, scuff resistance and folding endurance, it is likely to be employed to a large extent in the manufacture of multi-wall bags for industrial uses, storage out of doors being possible without fear of the bags becoming weakened. Bags, cartons, boxes and wrappers made from melamine-treated paper are assuming importance for general packaging purposes in the food industries. Wallpaper, similarly treated, has increased strength and attractiveness.

By the addition of two per cent. melamine size, paper can be obtained with a maximum wet resistance against tearing of about 30-60 per cent. of the dry state. Melamine size attaches itself to cellulose without the use of special precipitants. The action of the resin does not reduce moisture absorption, but binds the fibres and so causes them to resist separation when wet. The results obtained are durable even in prolonged storage under high temperature and humidity conditions.

Another important, although specialized, wet-strength agent is polyvinyl alcohol. This polymer can be used to produce an improved type of paper towelling, with an estimated fourfold increase in wet strength. The use of polyvinyl alcohol for treating paper towelling, paper handkerchiefs, serviettes and lens-wiping tissues, does not reduce the rate of moisture absorption, which needs to be kept at the maximum, but merely increases durability and limits objectionable linting.

In the treatment of paper, to impart special properties, such as resistance to grease, petrol, water, etc., a number of plastics have claims which deserve consideration. Polyvinyl alcohol is capable of offering a high resistance to dry cleaning and degreasing solvents, as also towards petroleum, oils and greases. It is already finding applications in the manufacture of protective clothing (gloves, caps, aprons, etc.) for workers in oil refineries and similar situations. Both cellulose acetate and ethyl cellulose are useful for endowing paper with grease-resistant properties.

The highest degree of moisture resistance is imparted by coating the surface of the paper with an impermeable layer of plastic material, such as polythene or polyvinyl chloride or polyvinylidene chloride. The polythene is used as a hot melt, the vinyl polymers as a paste or latex. So far, the use of polythene is still experimental, but application is very simple. Generally speaking, the method consists of melting

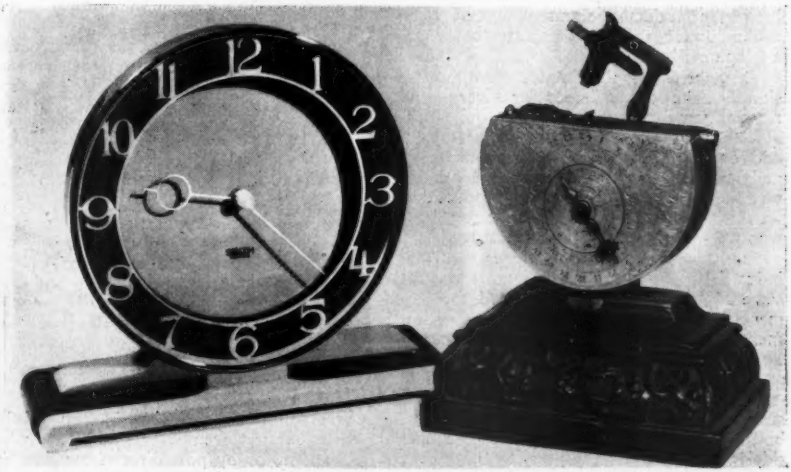
the polythene in the presence of an inert gas (nitrogen) and then spreading it upon the paper with a doctor knife. Adhesion to properly dried paper is good, and the treated material is suitable for many packaging purposes.

Pastes of the p.v.c. type, suitable for spreading, are well known to British paper manufacturers. The paste may be spread by means of the usual doctor knife and then gelled by heat treatment.

A polyvinylidene coating latex is the latest development in plastic coatings for paper. This material is claimed to give thermoplastic coatings of high gloss and toughness and with high resistance towards water, oil and common solvents. The latex can be applied as water dispersions, thereby eliminating fire hazards, cost and toxicity of solvents, and installation of expensive recovery plant. The coating is readily handled on machines which are built for applying mineral coatings or coloured pigments to paper.

Turning to the use of plastics for surface finishing or coating papers, ethyl cellulose and acrylic emulsions, as well as the vinyl polymers already mentioned, are rapidly assuming importance. Hot-melt compositions built up largely of ethyl cellulose enjoy certain advantages. They can be made stable to heat and possess excellent thermoplasticity; they dissolve readily in several hot resins, plasticizers, oils and wax mixtures. Numerous possibilities exist for the hot-melt coating of paper with resin and plasticizer mixes toughened with ethyl cellulose.

Acrylic emulsions are comparatively recent additions to the range of coating agents. They are fairly easy to apply to the paper base, and will key well; the coating, which may be modified in a number of ways, is resistant to water, oils, petrol and common solvents. Both ethyl cellulose and acrylic emulsions can be used for paper laminates.



Timepieces of modern and antique workmanship were shown side by side at a "Pageant of the Hours" which Smiths Electric Clocks Ltd. organized at the "Daily Mail" Ideal Home Exhibition at Olympia, in London. Our illustration shows two of the exhibits. The "Essex" clock (left), one of a wide range of models made by Smiths, has a moulded urea-formaldehyde case of pastel shade, relieved with black phenolic, height 6¾ ins. The flint-lock alarm clock (right) circa 1600, roused the sleeper by igniting a charge of gunpowder with a spark from flint and steel falling upon tinder.

Book Reviews

British Catalogue of Plastics: an Encyclopædia of the Plastics Industry for all Users of Plastic Materials. Pp. 704. National Trade Press, Ltd. 50s. net.

This excellently printed and produced compilation is also labelled "Encyclopædia," and presumably is a production based on the idea that as much information about the plastics industry should be crammed between two covers. However, this is not our idea of what a catalogue should be, for the simple reason that there is much too much information, a great deal of it being, in our opinion, misplaced.

Being an expensively and, from a printing point of view, very efficiently produced job with serious intent, it may be worth while indicating what kind of book we think the industry requires.

First and last we consider that the purpose of a catalogue, regarded as an instrument of trade, is to advise buyers of the names of companies that produce the goods they require. There should be not only as complete as possible a list of moulders and fabricators, in the present instance say some 500 to 800 concerns, but also as complete a list of the products each manufactures. Such a compilation should be as easy to read as a telephone book.

This, perhaps, is the simplest form; but we should make it even larger for a very good reason, namely, that it would be quite suitable to include a list of those manufacturers and engineers who produce raw materials and machines for the industry. This latter section, describing fully such productions, would provide a second catalogue for those who wish to enter the plastics industry itself.

Surely the trader or exporter and the industrialist does not require more at this stage of his inquiries. Easy to read, requirements rapidly found, free from advertisements, free from all such encumbrances as metric and avoirdupois tables, patents, and the temperature of steam at 50-lb. pressure, which is so evident in many catalogues, such a book would be immensely useful both to the plastics industry and those outside it.

As a sop, perhaps a necessary one, we should include a list of books and journals appertaining to the industry.

We should not include one word on the production of the raw materials, for this cannot be understood adequately by the non-chemist and is available in the prolific literature on the subject. We should likewise include nothing on the uses of plastics, for, here again, the literature is extensive. We should include nothing on a mould making or mould design or industrial design. Yet all these are included in the "British Catalogue of Plastics," with the result that it is a book weighing over 5 lb.

This apparently severe criticism does not infer that the "technical" material is useless. On the contrary, it is very good. We wish to infer that if the publishers were to issue the material in three separate volumes, the first a true catalogue, the second on technical information, and the third on applications of plastics in industry, they would please a very large public.

Advanced Industrial First Aid. By R. A. Trevethick. Pp. 63. Henry Garnett and Co., Rotherham. 3s.

The author of this small book is resident medical officer at the Peech and Tozer branch of the United Steel Companies, Ltd. The matter was, in the first place, specially written for the use of the various first-aid teams throughout the company's works, but in view of the many requests received from outside bodies it was decided to have it republished. Shock, wounds, burns and scalds, hæmorrhage, fractures, dislocations, sprains and strains are all dealt with in turn, and signs and symptoms, and the necessary treatment in each case, appear to be set out in a very lucid manner.

Woodflour. By W. S. Dahl. Pp. 119. 21s. net.

This booklet, an elaboration of a pamphlet originally presented free by the author, is a compilation from various sources of the many uses in industry of woodflour and sawdust. The covers are stiff, but the price is stiffer—far to stiff for what is between the covers.

Temple Press Books

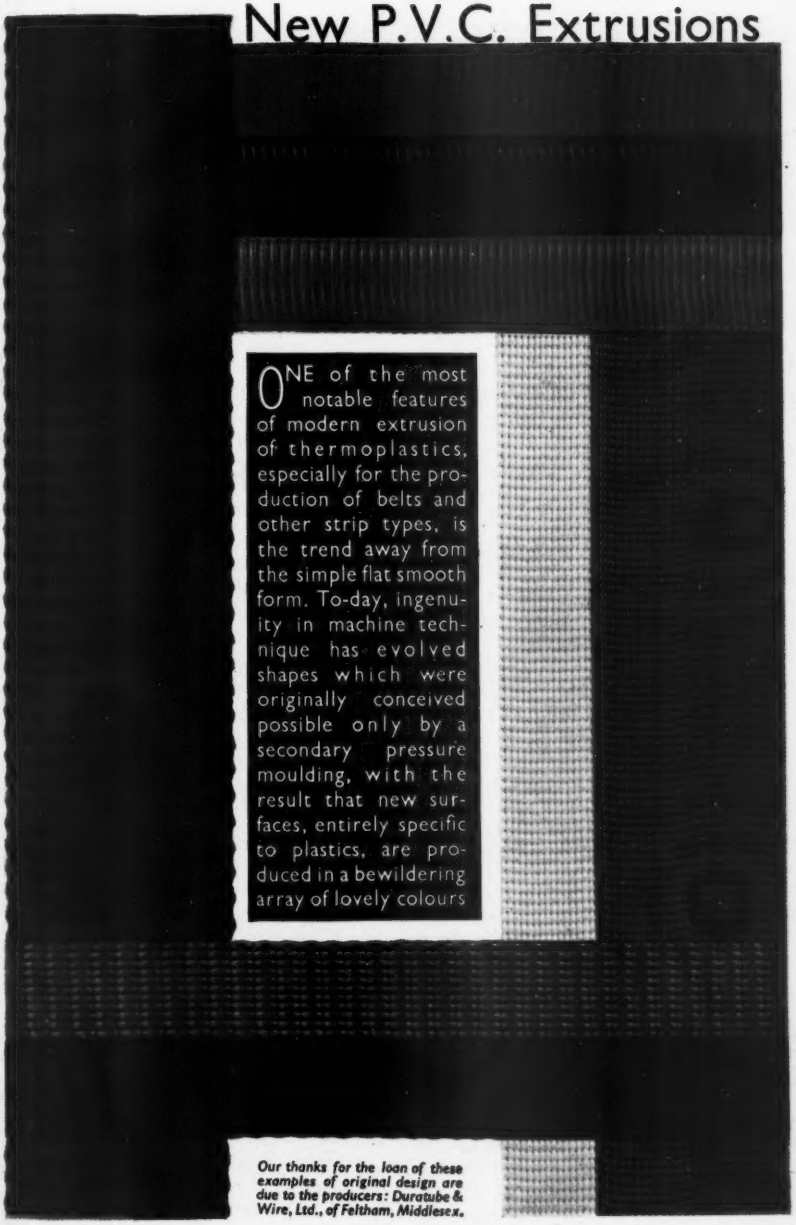
The following books of interest to the plastics industry are now obtainable from all booksellers, or by post direct from Temple Press Ltd., Bowling Green Lane, London, E.C.1:—

"Plastics Manual," by H. R. Fleck, M.Sc., F.R.I.C., price 15s. (by post, 15s. 6d.).

"Student's Manual No. 1.—The Theory of Polymerization," by H. R. Fleck, M.Sc., F.R.I.C., price 10s. 6d. (by post, 11s.).

New P.V.C. Extrusions

ONE of the most notable features of modern extrusion of thermoplastics, especially for the production of belts and other strip types, is the trend away from the simple flat smooth form. To-day, ingenuity in machine technique has evolved shapes which were originally conceived possible only by a secondary pressure moulding, with the result that new surfaces, entirely specific to plastics, are produced in a bewildering array of lovely colours



Our thanks for the loan of these examples of original design are due to the producers: Duratube & Wire, Ltd., of Feltham, Middlesex.

Continuous Nylon Monofil

By John S. Trevor

THE recent introduction of continuous lengths of nylon monofil for fishing line and tackle has encouraged manufacturers in several industries to think that this interesting material will soon become available for general applications. There are several uses already indicated, the most important being as follows:—

(1) Screens for sieving purposes in the flour milling, confectionery, toilet, pharmaceuticals and chemical trades.

(2) Domestic sieves.

(3) Insect repellant screens for export trades.

(4) Filter cloths.

(5) Sewing thread in the boot and shoe industry.

For the first-named, the outstanding properties of nylon include exceptionally high abrasion resistance, excellent heat resistance and immunity to attack by fungi and micro-organisms, the last virtue being of considerable importance in food factories. Added to these is the fact that nylon is not appreciably affected by long exposure to air at relative humidities ranging from 0-100 per cent.

Sieves are quite important domestic accessories, and there is a market for those made of nylon on account of their attractive appearance and greater durability. There is also the fact that when wire sieves break there is always the danger of small pieces of very sharp metal being swallowed in foodstuffs and causing serious internal injury. With nylon there is no such hazard, as even if fragments are consumed there would be very little risk of delicate membranes being scratched or punctured.

In many parts of the world screens are installed in houses, factories, and commercial buildings as a protection against insects. Nylon is most suitable for this purpose and fabrics of woven monofil have already been extensively tried out in the U.S.A. and Canada. A new development is the production of an inherently insect-repellent screen.

Canadian Patent 443,413, taken out by Canadian Industries, Ltd., covers the production of a screen with non-slippable contacts, which is made of polyamide filaments having an insect repellent agent incorporated therein. In the process of fabricating the screen, a melting point depressor is incorporated with the surface nylon. This enables union at points of crossing of the monofils to be effected by heating the structure to a temperature above the resultant melting point of the surface polyamide, but below that of the nylon where no melting point depressor has been incorporated.

Filter cloths woven of nylon monofil are likely to be of interest to many industries using heavy-duty filters. One great advantage of nylon filters over those made of natural fibres is that cake removal is easier, and the length of time taken for cleaning correspondingly reduced. Although the softening point of the British polymer is 264 degrees C. (measured in an inert atmosphere) it should eventually be possible to produce a modified polyamide having a higher softening point.

Nylon monofil for sewing thread in the footwear industry is likely to assume importance, as it is particularly adaptable to a new method of sewing lock-stitch seams without a bobbin. The invention of a new outsole stitcher recommends nylon, and in the stitch operation the protruding ends of the stitch loops are left high enough above the sole so as to enable a presser foot fitted with a heated element to flatten and set these loops. Although ordinary thread may be used, provided that it is coated with a suitable solidifying substance, such as ordinary wax, there is always a danger that the use of too stiff a coating may result in a seam that is not so flexible as nylon.

Cellulose Acetate Plastics

XI.—Manufacture of Moulding Powder (Contd.)

By
Vivian Stannett

ILLUSTRATIONS of some of the heavy compounding equipment mentioned in the last instalment of this series have now become available for publication and are shown in Figs. 1 to 5 by courtesy of Farrel-Birmingham Co., Inc., Ansonia, Connecticut, U.S.A.

The Banbury mixers are available commercially in a complete range of sizes from small laboratory machines, handling about 8 oz. of cellulose acetate plastic stock at a time, to huge machines capable of compounding about 1,200 lb. of material. In this type of machine cooling of the mix is often necessary, and this can be accomplished by circulating cold water through the cored rotors and sides of the mixer, but some mixers are fitted with spray-cooling equipment. The two methods are shown in Fig. 1; a front view of the Banbury mixer is seen in Fig. 2.

Regarding compounding rolls, the type referred to in the last instalment is shown in Figs. 3 and 5. The particularly large set were specially developed for acetate moulding powder manufacture and have proved very popular in the United States. In this mill the 24-in. by 66-in. rolls are carried in special journal boxes fitted with continuous circulating systems to provide adequate lubrication for high-temperature operation. The motor-driven roll adjustment, with vernier dial indicators on the adjusting screws, provides for quick and accurate control of gauge. The rolls are chrome-plated, and the guides made of stainless steel to prevent contamination of the

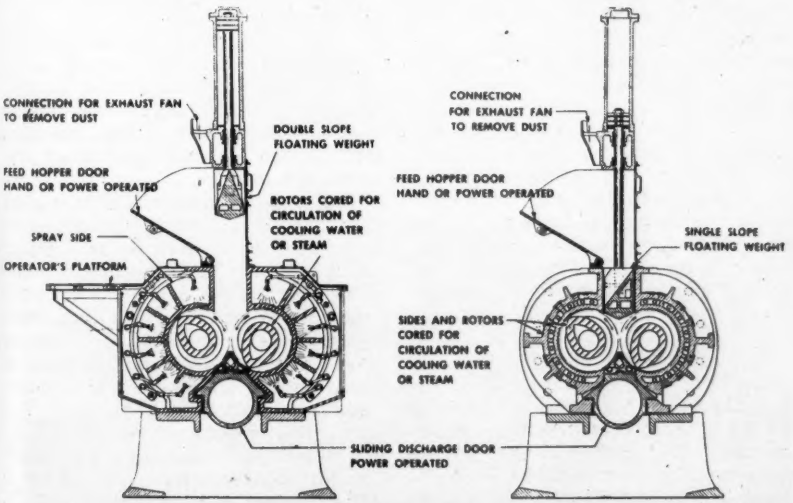

CONNECTION FOR EXHAUST FAN TO REMOVE DUST
DOUBLE SLOPE FLOATING WEIGHT
FEED HOPPER DOOR HAND OR POWER OPERATED
ROTORS CORED FOR CIRCULATION OF COOLING WATER OR STEAM
SPRAY SIDE
OPERATOR'S PLATFORM
CONNECTION FOR EXHAUST FAN TO REMOVE DUST
FEED HOPPER DOOR HAND OR POWER OPERATED
SINGLE SLOPE FLOATING WEIGHT
SIDES AND ROTORS CORED FOR CIRCULATION OF COOLING WATER OR STEAM
SLIDING DISCHARGE DOOR POWER OPERATED

Fig. 1.—Cross-sections of Banbury mixers, with (left) spray-cooled sides and (right) cored sides. (Courtesy, Farrel-Birmingham Co., Inc.)

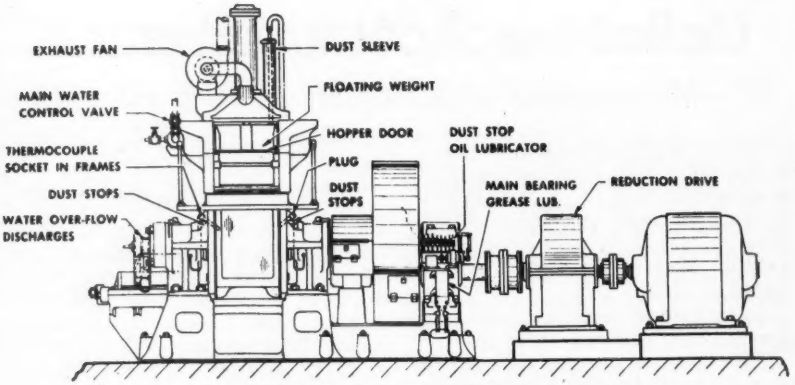


Fig. 2.—Front view of Banbury mixer, with reduction gear unit and motor. (Courtesy, Farrel-Birmingham Co., Inc.)

stock. The mill is driven by an individual motor through a two-speed right-angle gear unit. The two-speed drive affords flexibility in working stocks at optimum speeds, and the right-angle arrangement of the drive makes a compact installation in minimum floor space. The rolls are chamber-bored, and are fitted with a special type of stuffing box designed for high temperature.

XII.—The Extrusion Process

THE extrusion of sheet cellulose acetate by specially developed processes was described in the last instalment. In addition, however, to this special application of the extrusion process, there is the rapidly expanding outlet for more conventionally extruded products of cellulose acetate. These include tubing, rod, and shaped profiles which find extensive use for curtain railing, picture framing, table top edging, etc. Indeed, it would appear that eventually the output of the extruder will equal or even exceed that of the injection moulding machine.

Wet Extrusion Process

The earlier method used for the extrusion of cellulose acetate plastic rods and tubes was taken over from the celluloid industry. This method is still used by some manufacturers and simply consists of an hydraulic stuffer fitted at one end with the extrusion die. In many factories, vertical hydraulic filtration units were simply adapted for extrusion by fitting a cross-head die unit on the outlet end. It should be emphasized that the material used for this method is a solvent-containing dough taken directly from a Werner-Pfleiderer-type dough mixer. Consequently, the extruded sections must be thoroughly dried and seasoned before use.

This type of extrusion is often carried out without heat, but the application of heat is a definite advantage as it brings about reduction in the viscosity of the dough and enables a material of minimum solvent content to be extruded with a consequent reduction of seasoning time. The heat is applied by passing steam through the walls of the cylinder, which are cored for this purpose. The ram itself is not usually heated.

This method is becoming rapidly obsolete for cellulose acetate extrusion as it suffers from the following definite disadvantages: (1) A long seasoning time is required before the extruded section is

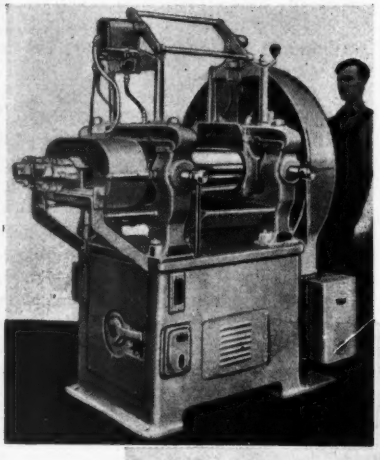
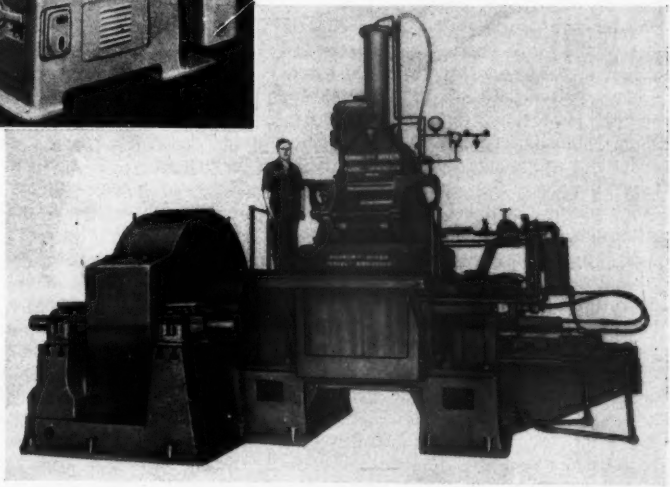


Fig. 3 (left).—Self-contained plastics mill, rolls 8 ins. by 16 ins., with motor drive enclosed in case. (Courtesy, Farrel-Birmingham Co., Inc.)

Fig. 4 (below).—The largest size in Banbury mixers (size 27) with a capacity of 600 lb. of crude rubber or approximately 1,000 lb. of 1.50 gravity stock. (Courtesy, Farrel-Birmingham Co., Inc.)



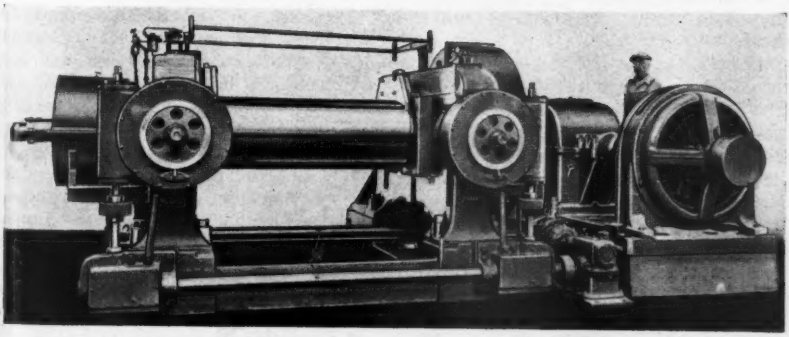


Fig. 5.—Plastics mill, rolls 24 ins. by 66 ins., with two-speed right-angle drive and motor-driven roll adjustment. (Courtesy, Farrel-Birmingham Co., Inc.)

ready for use. (2) The dimensions of the extruded section are extremely difficult to control, owing to the shrinkage which inevitably accompanies the loss of solvent, i.e., during seasoning. (3) It is necessarily a discontinuous, or batch, process. However, it is still the main method used for cellulose nitrate extrusion.

Dry Extrusion Process

The dry extrusion method involves direct extrusion from solvent-free cellulose acetate moulding powders. For the best results, special extrusion grades of powder are employed. These contain less of the more volatile plasticizers and a higher percentage of the highly non-volatile plasticizers than is usual for normal injection moulding powders. This results in a minimum of distortion occurring as the plastic section emerges from the die. For the best results, a quick-setting composition is essential. Although hydraulic machines have been used, these suffer, among other disadvantages from being discontinuous in operation and are very rarely employed. Nearly all the thermoplastic extrusion machines on the market to-day are operated by the continuous screw principle, which was originally introduced around 1880, and came into use for the dry extrusion of cellulose acetate plastics beginning in 1938.

The simple principle of this process is seen in Fig. 6. As the screw carries the moulding powder forward through the heated cylinder, it mixes and softens to a plastic condition, and, finally, it is forced out through the forming die at the exit end. The cylinder is heated in several zones and the screw is also often fitted with a heating core, but it is not usual in the case of cellulose acetate extrusion to heat the screw except in so much as it is heated by conduction and by frictional heat.

The Extrusion Machine

It can be seen from Fig. 6 that the essential components of the continuous screw extruder consists of the cylinder, the screw, the screens, and the forming die; the process itself comprises the feed, heating, and driving of the screw, i.e., the motive power.

The cylinder is made of high-grade steel or special non-corroding alloys, including stainless steel, although in the case of cellulose acetate little corrosion is experienced compared with many other thermoplastics which are used for extrusion. The surfaces in contact with the plastic material are sometimes chromium-plated to give greater resistance to wear and possible rusting during shut-down periods. The modern tendency, however, appears to be to avoid plating, owing to the possibility of stripping under the intense stresses which may be developed during extrusion.

The screw is also made of high-tensile, non-corroding and hardened ferrous alloy. It is driven by an electric motor equipped with an infinitely variable gearbox with positive drive to ensure uniform delivery of the plastic material at the exit end. The power of the motor varies, a motor of about 10 h.p. being used for 2½-in. diameter screws, whereas a 40 h.p motor is used for 4½-in. diameter machines. The screw rotates within the cylinder, making a very close fit. Most commercial machines have the screws cored for heating or cooling, but the general practice with cellulose acetate extrusion appears to favour an unheated screw.

The design of the screw is extremely important, and varies with each manufacturer. It is apparent that the rate of travel of the material through the machine must be greater at the feed end, and decreasing somewhat as compacting and consolidating takes place This can be accomplished in several ways by decreasing the pitch at the exit end or by varying the depth of the screws. Another method would be to cut the thread more deeply at the feed end, but this would lead to an inevitably weakening of the screw at the drive end. One further way would be to add an extra set of flights at the exit end, but this would be a more expensive method. The

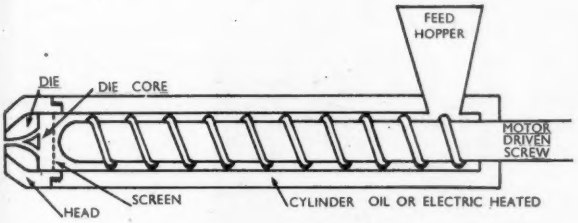


Fig. 6. — Simplified sketch of extruder, showing principle of operation.

usual practice is to have either a constant depth with a decreasing pitch screw or a changing depth with constant pitch, the former method being the more commonly used at the present time.

The screw itself can either finish in the conventional fully flighted way or be fitted with a smooth "torpedo" or "spreader" section. In the latter case, this straight portion has a rather smaller diameter than the threaded portion. It is preferable in the case of cellulose acetate extrusion to use a screw with a torpedo end. The feed hopper is usually centred directly over the screw, although, according to Akin, a tangential feed is far preferable, as it prevents clogging and agglomeration. This authority also points out, however, that the same results can be obtained less expensively by cutting a slot in the bottom of the sleeve a few inches away from the feed chute. The screw is usually run at speeds varying from about 10 to 35 r.p.m., depending on the flow quality of the material being extruded and on the dimensions and design of the die.

Heat Source and Control

The temperature of the material is gradually raised as it passes through the cylinder. This is carried out by dividing the cylinder into several heating zones which are usually thermostatically controlled. The two different types of heating most commonly used are hot air circulation or electrical resistance heating. The modern tendency appears to be to favour electrical heating, as this is cleaner and without the risk of any oil leaks occurring; the power consumption is less in the case of electrical heat. Some

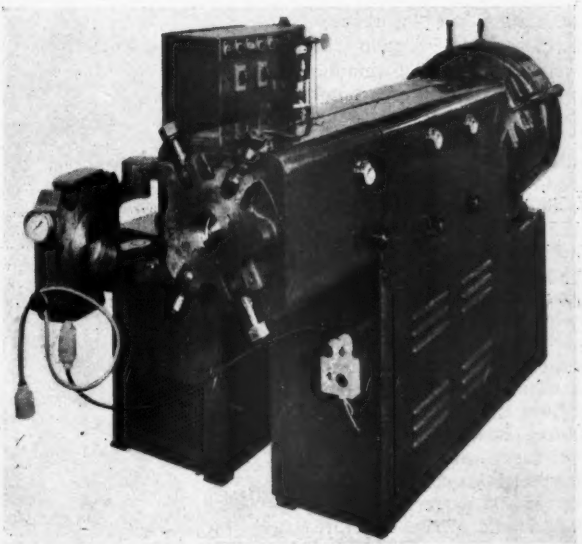


Fig. 7.—3½ in. N.R.M. oil-heated extruder for thermoplastics. (Courtesy National Rubber Machinery Co., Akron, Ohio, U.S.A.)

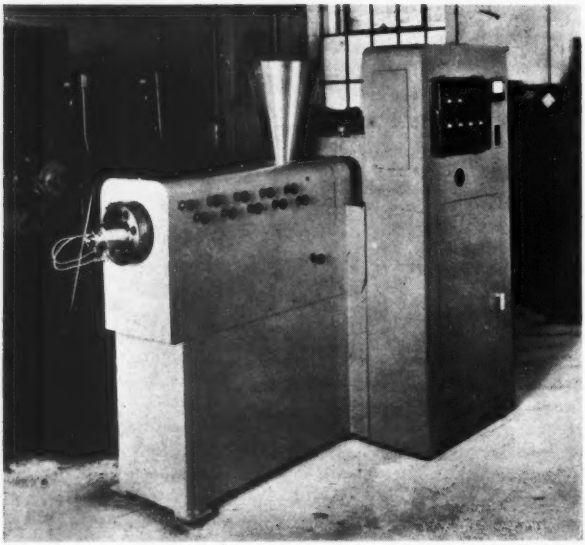
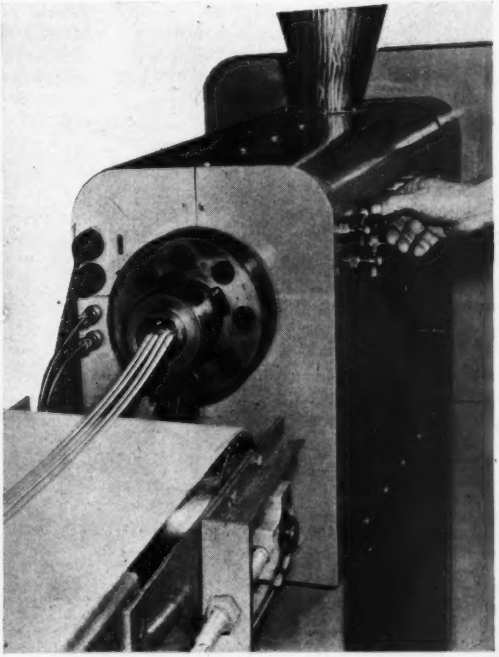


Fig. 8 (left).—2½ in. electrically heated extruder for thermoplastics. (Courtesy, Modern Plastic Machinery Corporation, Lodi, N.J., U.S.A.)

Fig. 9 (below).—View of die in operation on 2½ in. extruder. (Courtesy, Modern Plastic Machinery Corporation.)

idea of the power consumption is given by the calculations of Akin.[1] He calculated that 20 lb. of cellulose acetate is extruded per kilowatt-hour of heating; a 2½-in. diameter screw would extrude this weight in about 20 minutes, which, with a 10 h.p. motor, consumes about 2 kilowatt-hours. To prevent agglomeration and sticking at the feed end, this section of the cylinder is usually cooled; heating is begun, however, as near as possible to the feed end in order to relieve the load on the screw as much as possible. The actual temperatures vary with the flow properties of the extrusion material, but, as an example, figures have been quoted[2] for three heating zones, 335 degrees F. at feed end, 350 degrees F. in centre, building up to 400 degrees F. at the nozzle end, whereas the area



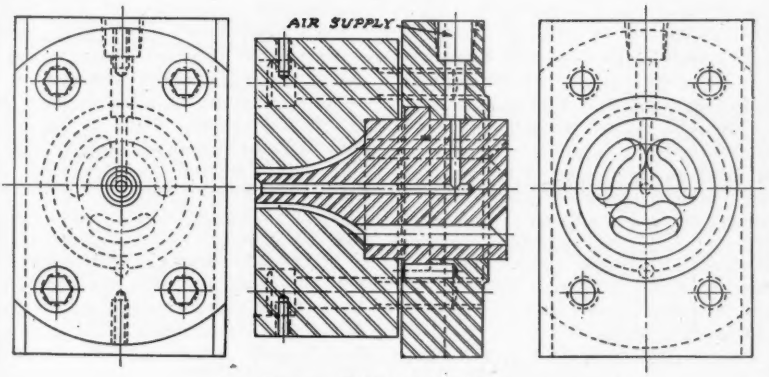


Fig. 10.—Tube die: fixed type.

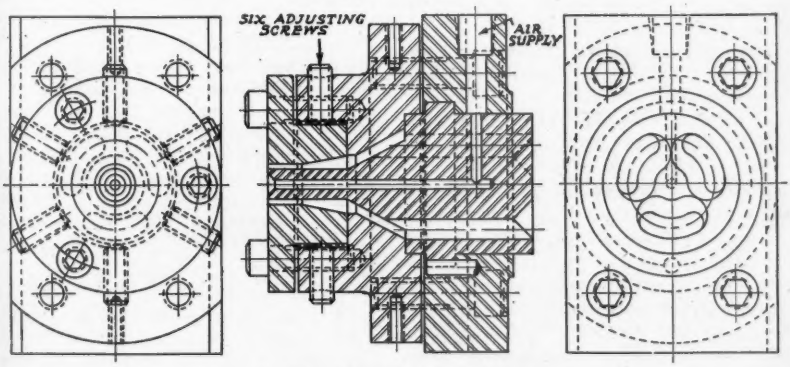


Fig. 11.—Tube die: adjustable type.
Typical designs of dies for continuous extrusion. (Courtesy, Tennessee Eastman Co.)

directly by the feed should be kept at about 180 degrees F. or less.

In addition to the heat supplied to the cylinder, the die itself can also be heated. The frictional heat developed during extrusion is considerable, and can result in the development of temperatures 20-30 degrees F. above that of the heating zone temperatures. To even out any frictional heat which develops, some modern machines have a number of cooling zones; for example, the machine shown in Figs. 8 and 9 has about eleven sections to allow cooling by cold water, air or oil circulation. The cooling zones are in addition to the normal electrical heating sections.

Screening and Die Design[3]

The insertion of a screening assembly serves a number of useful purposes, in addition to the obvious one of removing foreign matter which may have been present. These include the development of back pressure, which provides greater uniformity and reduces natural pulsations. Furthermore, it gives better mixing and greater homogeneity of the plastic material. Screening is particularly valuable when the extrusion orifice

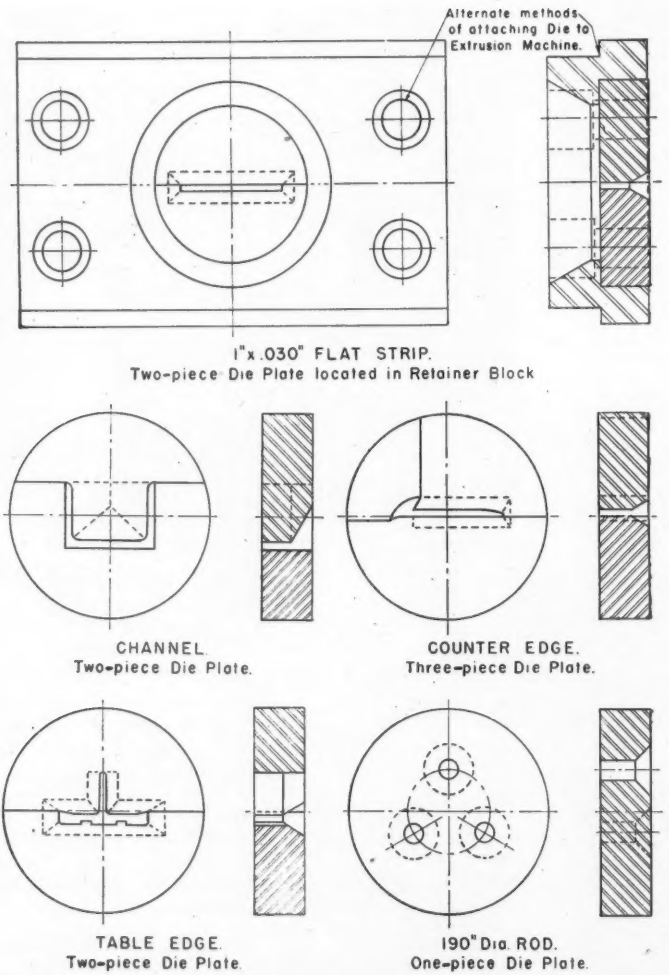


Fig. 12.—Typical designs of dies for continuous extrusion. (Courtesy, Tennessee Eastman Co.)

is too large to ensure the development of sufficient back pressure. The result is usually a reduction in extrusion speed, but improved uniformity and finish. The screens are usually of stainless steel wire and are backed onto a perforated steel plate, sometimes with a coarse screen between the finer screen and the steel plate; 40-80 mesh is a standard size range for cellulose ester extrusion.

Most extrusion dies, other than those for tubes, are relatively simple and consist essentially of a die plate and a retainer block. The die plate may be made in one piece, or in a number of segments to facilitate machining, and

should be a light press-fit in the retainer block. While one retainer block can be made to serve a number of die plates, it is recommended, when practicable, that each die plate be provided with its individual retainer block (which is ordinarily made from mild steel) to protect the die against damage when not in use. The die plates, usually made of carbon steel, are not hardened and polished until trials in the machine have determined that the design is correct.

No specific rule on design can be given which will apply to every type of extrusion die. Almost every new shape presents a new problem. Dies should obviously be of a size within the capacity of the machine for supplying material heated to suitable plasticity for extrusion. An important consideration in the construction of dies is the length of the land, or the straight section through which the material last passes before emerging. It should be long enough to secure the necessary back pressure, lustrous finish, and elimination of excessive shrinkage. It should not be so long as to retard materially the rate of extrusion.

In general, the dimensions of the orifice are the same as, or up to 25 to 30 per cent. larger than, the shape to be made. By regulating the speed of the take-off belt, the shape is drawn down to the desired dimensions. Consideration must be given to variation in frictional drag of material in the die. Where friction is likely to be greatest, it must be offset by larger cross-section.

The draft of the orifice is greater in width than in thickness. If, for example, a strip were extruded from a die of rectangular cross-section, it would be thicker at the centre than at the sides. To correct this condition the length of the land should be reduced at the sides, thus lowering the resistance to flow and providing a uniform flow across the entire cross-section.

Similarly, in extruding an L-shaped counteredge strip, where one edge is much heavier than the other, the length of the lip on the die forming the thin edge should be shorter to obtain equal flow of the section in each plane. The heavier the section the longer is the land required to prevent formation of bubbles in the extruded shape.

For best results, the die is provided with an independent heating arrangement such as a strip heater, covered with asbestos. This eliminates sticking of material in the die when starting a job, and permits operation at the temperature which provides easy flow at the point of formation and the best surface finish on the extruded shape. To maintain uniformity in dimensions of the extruded product, control of temperature at the point of formation is most important.

For uniformity of dimensions, it is absolutely necessary that the air pressure be constant. If the air line used serves other operations in the plant, fluctuations in pressure are inevitably encountered, and it is advisable to install a surge tank, or possibly two surge tanks in series to cut down the variation in pressure. In addition to the final regulating valve, there should also be a reducing valve in the line. The air entering the interior of the tube at low pressure serves to support and to cool it.

The diameter of the tubing may be increased by increasing the air pressure, but it is difficult to control dimensions by this method. Ordinarily, with a die of given dimensions, the dimensions of the extruded tubing may be controlled within limits by regulating the rate of extrusion and the speed of the conveyor belt. Increasing the speed of the conveyor draws down the tubing, at the same time diminishing the wall thickness.

Fig. 10 illustrates the fixed type of tube die; Fig. 11, an adjustable type. In the fixed type, the core forming the inside of the tube is fitted in the block, which is bored to form the outside of the tube. This type of die is used where concentricity and wall thickness need not be held to close tolerances. Where accurate dimensions are desired, the adjustable type is used. In this type, the core forming the inside of the tube is in a fixed

(*Continued on page 278*)

L

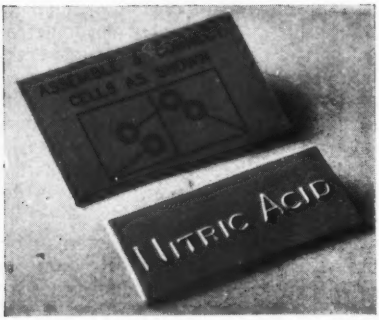
LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Labels for Fruit Trees

Sir,—In your April issue you published a letter under the heading "Labels for Fruit Trees." Your correspondent might be interested in litho-printed "Tufnol" for this purpose. Labels made by this process would have the printed matter below the surface of the material; it would therefore be protected from the effects of the weather and from scratching.

TUFNOL, LTD.
121, Victoria Street,
Westminster, S.W.1.



Sir,—We were interested in the letter and note under the heading "Labels for Fruit Trees" in the April issue of "Plastics."

We have been occupied for some considerable time in the supply and moulding of polythene for the chemical, pharmaceutical, cosmetic and allied trades, and we have decided that our future production will include an embossed label in polythene suitable for use with such things as carboys and export cases which may be stored for some considerable time out of doors. We realize that the polythene will remain permanent, and it is our intention to make the labels more suitable for this use by having them in different colours for the different contents, e.g:, red for nitric acid, green for caustic soda, etc. We enclose a sample label for your inspection.

It had occurred to us that such labels would also be eminently suitable for use out of doors in gardens and plantations, and here, again, the various colours and combinations of colour would, we think, be an advantage. Our method of production gives a fairly cheap product, as engraved moulds would be prepared as inserts for our master rollers.

AMPLEX APPLIANCES.
19, Dartmouth Road,
Hayes, Bromley, Kent.

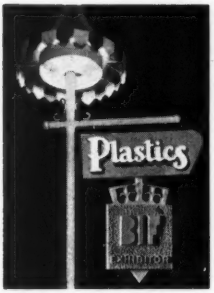
[EDITOR'S NOTE: Accompanying these letters we give photographs of examples of labels made by our respective correspondents; (top) Tufnol, Ltd., (bottom) Amplex Appliances.]

Chalk-white and Jet-black P.V.C.

Sir,—For a considerable time we have pleaded in vain with p.v.c. compound manufacturers to produce chalk-white and jet-black grades. These are available in America, but that does not help our home and export markets!

London. DISTRIBUTOR.

[EDITOR'S NOTE: We sympathize with the writer. Last month a visitor to this office complained that the so-called black p.v.c. on the British market was grey, when compared with good black "patent" leather. Perhaps all our good dyes are going abroad. An interesting comparison occurred in a recent "Focus on France" broadcast, when a French manufacturer complained of the poor quality of French dyes, although French dyes normally are of superb quality. We may also compare the situation with the fact that "seconds" and probably "thirds" in the "china" trade are reserved for the home market at fantastically high prices. In passing, we have supposed that the black highly glazed materials produced by BX Plastics, Ltd., B. Lipman (Plastics), Ltd., and Stanley Smith and Co. are all excellent examples of what is required.]



B.I.F. 1948

WE do not yet know how far buyers were stimulated by the phenomenal displays in the Plastics Section to empty their metaphorical pockets, but it is with considerable pleasure that we congratulate the majority of the stand-holders on a show that is undoubtedly a vast improvement on all previous ones, attaining a dignity that is still full of kaleidoscopic colour and clarity.

One of the greatest difficulties facing publicity in the plastics industry lies in the fact of its multitudinous manufactures. This is more obvious in the moulding industry itself, where not only size and type of units produced on the same machine can and do vary enormously, but the same object can often be made in different materials of a hundred colours and textures.

How can the onlooker be made to see the wood for the trees and how can the lesson of plastics be brought home to him without bewilderment, confusion and mental indigestion? Frankly, many exhibitions of the past have produced this sickness and the visitors have gone away with impressions of amazement and wonder without being able to give a clear idea of what they have seen.

It is, as we now see generally, quite unnecessary to pack the stand with samples of every conceivable moulding that has been turned out of the factory since the closing day of the past year's B.I.F. It is true that the plastics industry does not live on glory or the reiterated assurances by our "dailies" that, like our policemen, our plastics industry is wonderful. We have to sell our goods for hard cash. But also we still have to teach the public, and we believe this has now been achieved by a general improvement in cutting down the number of exhibits on each stand, introducing focuses on general or particular productions and, therefore, simplicity and clarity.

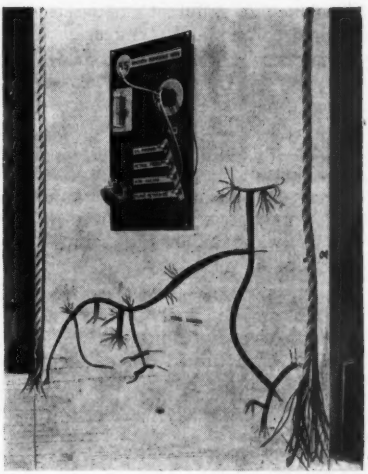
A number of exhibitors drew the eye to points where some half-dozen mouldings could be examined in detail. Others achieved the same effect by as little as two mouldings, one very large, the other very small, with enlarged photographic replicas of the presses and factory as a background to them. Again, the segregation into types of moulding, say, half a dozen separate and distinct cases of electrical, aircraft, automobile or fancy goods, and other types of moulding with photographs as backgrounds and the actual steel moulds from which they were made, introduced a tone of severe industrial practicability that was most salutary. The old sense of mere magic and touch of unreality in plastics is gone and is being replaced by a realization that, after all, while plastics are remarkable and even wonderful things, they are being produced in factories that in essence are as typically industrial as engineering skill and ingenuity can make them.

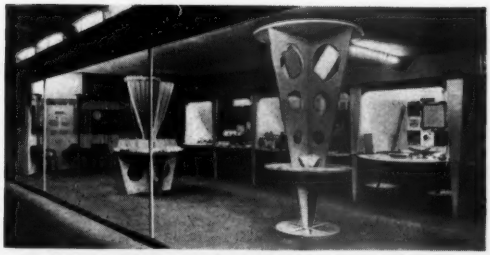
These new trends are, as will be seen from the photographs we publish on the pages following, mainly visible in the old and experienced concerns. There were still some "jumble sales," without clarity or shape. This type will, we hope, disappear altogether eventually and thus conform to the ever-increasing stature of a rapidly growing industry.

Further photographs, relating also to some of the exhibits at Castle Bromwich, will be published next month.

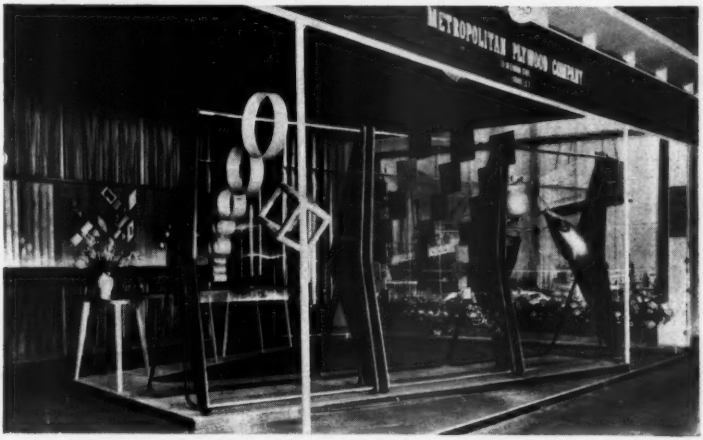
(Right) The stand of Ashdowns Ltd. is difficult to beat for clarity of exposition, introducing in one not only the range of their manufactures, but also a new process of permanent decoration in mouldings. This is seen in the coloured floral design on white plates.

(Above and right) Especially interesting exhibits on the stand of Duratube and Wire, Ltd., were the p.v.c. extrusions made for cable work, and the complete electric wiring system on a famous motorcar.



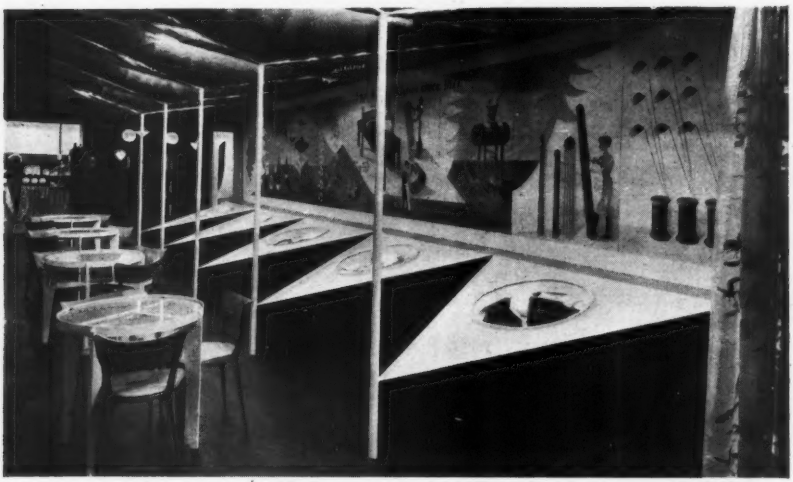


British Industrial Plastics, Ltd. sectionalized their display. Separate windows showed the use of urea resins for sand core binding, button making, gluing and fancy goods production, and an attractive display of mouldings in pastel shades from Melamine.

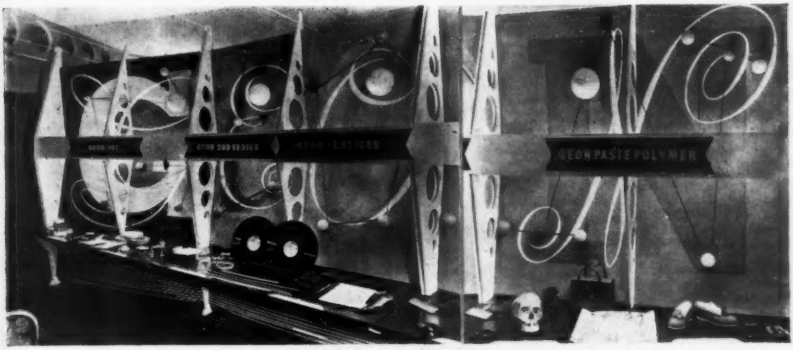


An imposing view of what modern plywood (i.e., resin-bonded) can mean to modern industry was seen on the stand of Metropolitan Plywood Co.

Segregation for clarity was evident at the stand of British Moulded Plastics Ltd., who mould a vast range of objects, large and small, industrial and otherwise, as is evident in the above photograph. In passing, we have never seen a trade mark so effectively used. Perhaps it is the simplicity of it that is so attractive.

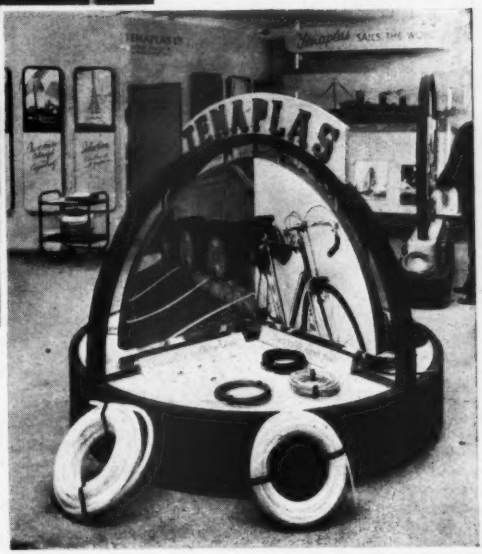


While the style of presentation was completely different from any other in the Plastics Section, the stand of BX Plastics, Ltd., with its enormous, colourful mural giving the history of the oldest company in the plastics field, was very striking. The triangular sloping panels completed the picture of its modern production.



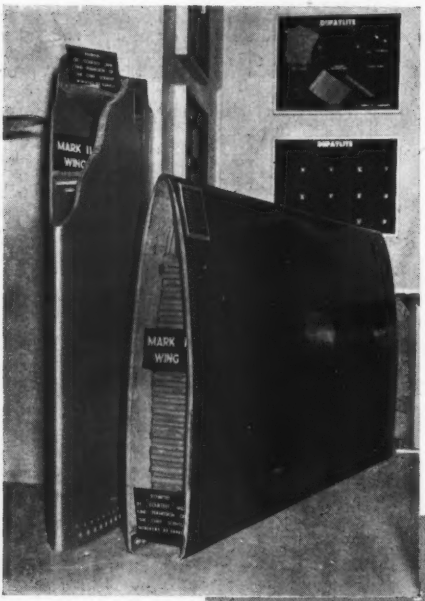
(Above) We welcome yet another newcomer (company and raw material). Geon, made by British Geon, Ltd., is a thermoplastic (or rather a series of thermoplastics) available in powder, latex or paste form, for making sheet, for coating or for moulding.

(Left) The exhibit of Fraser and Glass, Ltd., is sectionalized into industries, each section "supported" by the actual moulds which produced the goods.

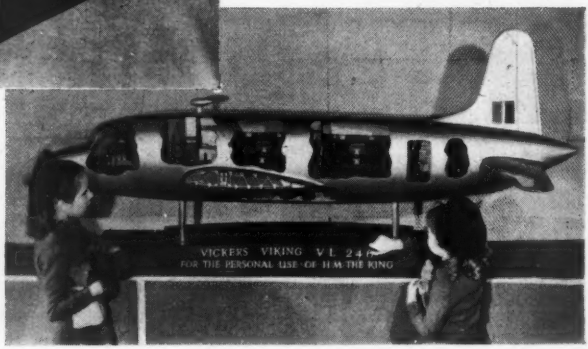


(Right) On the stand of Tenaplas, Ltd., the same effect of concentration in a small space is obtained, although in a completely different sphere. This company of extruders of tubes for electrical and a hundred other jobs, have laid especial emphasis on polythene pipes for breweries and water carrying.

(Right) Erinoid, Ltd., show the whole range of plastics which they produce, with many examples of the goods made with these materials. Emphasis is laid on the value of casein for colourful display.

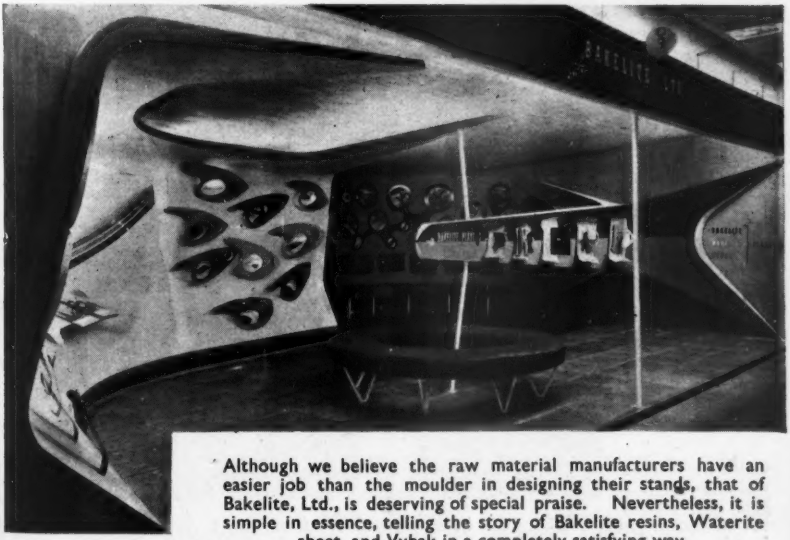


(Left) Aircraft wings incorporating Dufaylite honeycomb were seen at the stand of Dufay-Chromex, Ltd. Our illustration shows parallel research specimens representing the highly stressed part of a "Spiteful" fighter wing from the Royal Aircraft Establishment, Farnborough. Mark I consists of a continuous shell moulding of Durestos asbestos felt material impregnated with phenolic resin (Turner Brothers Asbestos Co. Ltd.), moulded at atmospheric pressure. The skin is glued over blocks of Dufaylite honeycomb, density 1 lb. per cu. ft., shaped to fit. This wing weighs 96 per cent. of the equivalent metal structure and failed at 117 per cent. of the design load. In Mark II the solid honeycomb core is replaced by a sandwich of Dufaylite on the compression face, with the weight reduced to 85 per cent. of the metal equivalent.

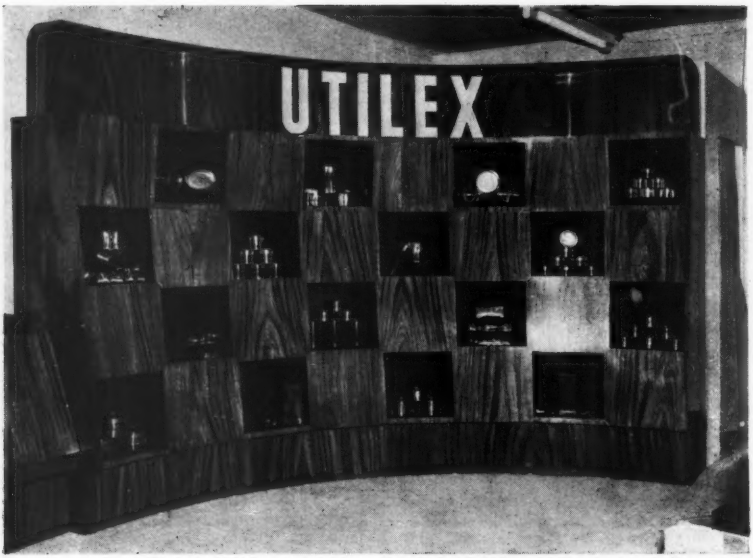


(Right) An impressive scale model of the Vickers "Viking" used by H.M. The King. Dufaylite honeycomb, laminated between sheets of plywood, is used for the purpose of reducing weight in this aircraft.

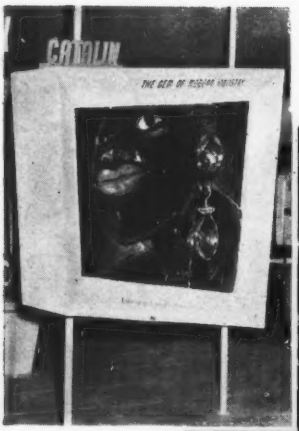
The versatility of cellulose acetate in rod, sheet, foil and powder form is already well known. At the stand of British Celanese, Ltd., we saw all these and the especial prominence given to a new departure by this firm—the extrusion of "Celastoid" tubing for the covering of wood and metal, for steel uprights, pram handles, etc., straight or curved.



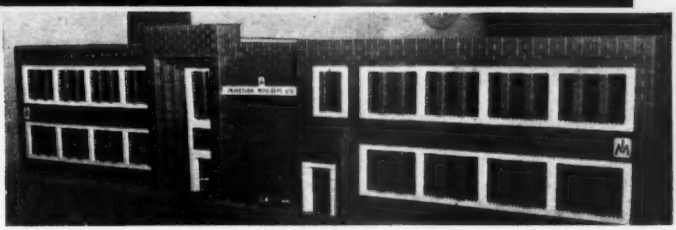
Although we believe the raw material manufacturers have an easier job than the moulder in designing their stands, that of Bakelite, Ltd., is deserving of special praise. Nevertheless, it is simple in essence, telling the story of Bakelite resins, Waterite sheet, and Vybak in a completely satisfying way.



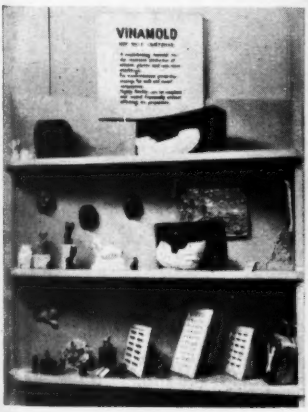
(Above) A delightfully refreshing manner of showing the manifold fabrications from cellulose acetate film was presented by Utilex, Ltd. Simulating half of a chess board, the dark recesses in the beautiful "veneered" whole formed a magnificent background to the transparent glittering boxes and other containers.



Catalin always was and still is a gem of a plastic, but in recent years Catalin, Ltd.; have widened the field of their basic resin to cover boat building, sand core binding for metallurgy, and a host of other new industrial uses.



This model of a factory is made from Hilary Page's "bricks," injection moulded by Injection Moulders, Ltd. Above, at the same stand, we see our old friend Islyn Thomas, of the Thomas Manufacturing Corporation, U.S.A., flanked by Mr. Ritchie and Mr. Davies, directors of Injection Moulders, Ltd. Mr. Thomas is examining a marvellously moulded helicopter just produced by the London Company.

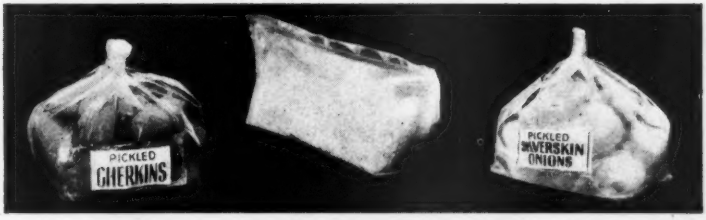


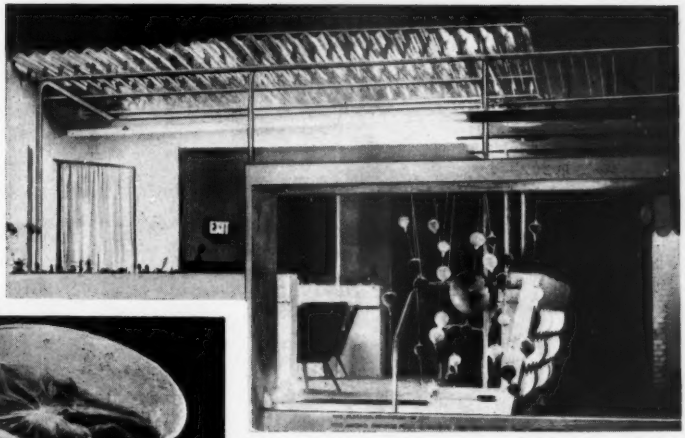
A new hot melt compound for the repetition production of plaster and cast resin mouldings (left) was featured by Vinyl Products, Ltd. Also shown (above) were p.v.c. pastes for paper and fabric coating, and emulsions for leather finishing, etc.

Raw material manufacturers of phenolics, cellulose acetate and polyvinyl types, British Resin Products, Ltd., cover many fields—moulding powders, coating compounds, glues, etc. With the phenolic glues, we now see being produced what is probably the finest barrel it is possible to make.

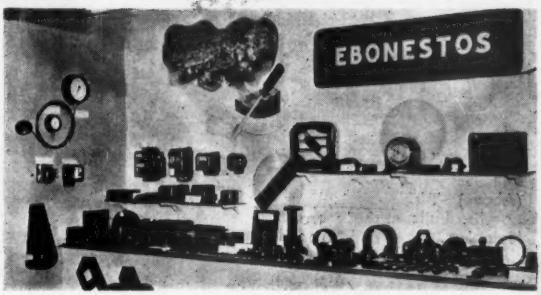
As a means of concentrating the visitor's gaze to one central exhibit, the fantasy by E. K. Cole, Ltd., was a model of exposition of the range of production; the surround in white, and the objects lighted from the interior, was most impressive.

"Lightness" was the keynote by Expanded Rubber Co., Ltd. All was of expanded plastics or rubber in sandwich or similar form—doors, life-belts, and chair-seats. A great novelty was the foamed urea resin, which simulates snow.

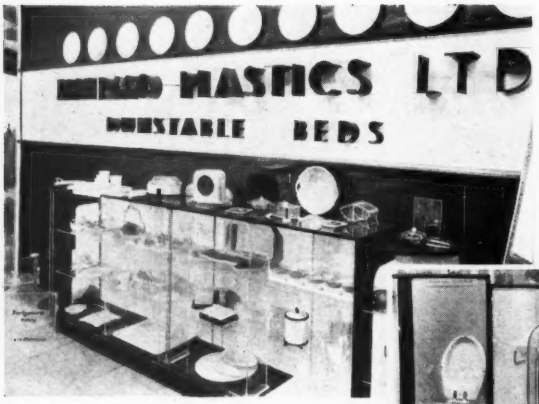




The I.C.I. (Plastics Division) stand was roofed in corrugated Perspex, which is now finding an enormous outlet in factory and farm building. There was also much to see in modern methods of utilizing nylon for industrial brushes. But the section devoted to the new thin polythene sheet intrigued us most, for whether it is the carriage of pickled gherkins or of a hygroscopic salt to the tropics, we have here one of the most striking solutions to some of our difficulties in transport and industry.



Among an extensive range of high-grade mouldings supplied to the electrical and other important industries in the country, a number of specially intricate mouldings were shown by Ebonestos Industries, Ltd.

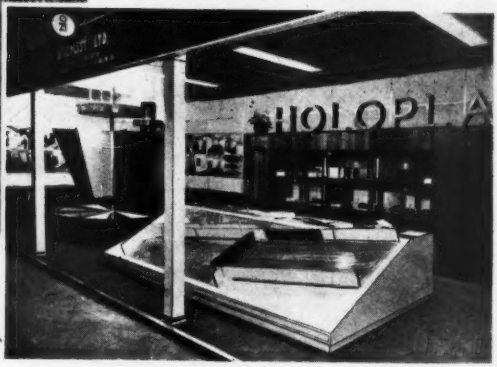


(Left) Thermo-Plastics, Ltd., exhibited a wide variety of fabrications from thermoplastic sheet, their fancy goods ranging from clock-cases, to trays, frames and boxes.

(Right) On the "industrial" side the same concern showed a "complete" kitchen, and lavatory, and a fine example of intricate forming in the shape of a demonstration refrigerator.

(Above) These telephone booths, built entirely from Holoplast, provided both strength and silence.

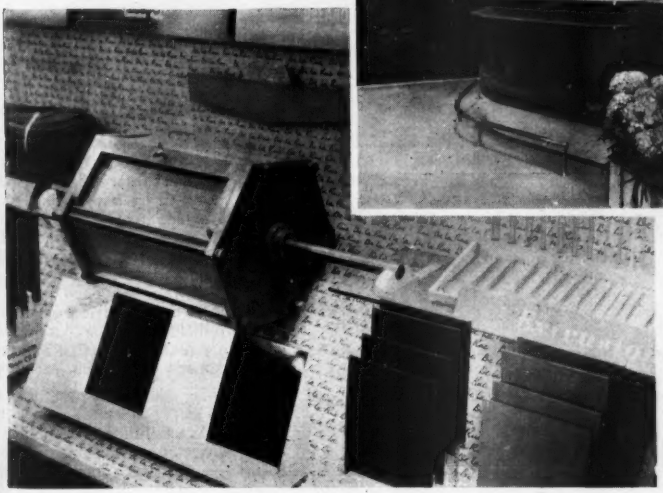
(Below) The exhibit of Holoplast, Ltd., showed the girder principle of construction, and therefore gave a forceful idea of the great strength of this building material.

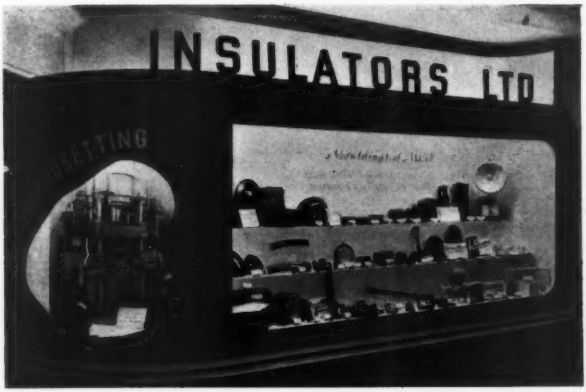


(Left) There were many exhibits on the stand of British Artid Plastics, Ltd., but easily the most striking which caught everybody's eye was the dresser with kitchen crockery in pale blue melamine resin, which occupied almost the whole front. It was exceptionally attractive.

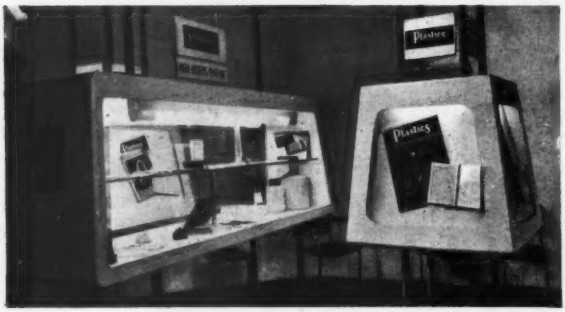
(Right) The cocktail bar by De La Rue Insulation, Ltd., in Traffolyte and Formica, with grey "linette" unstainable tops and lovely, decorated front and walls, was a delight.

(Below) Here also the same company showed more technical applications. The tumbling barrel for metal pickling is an excellent example.





(Right) We like the method adopted by Insulators, Ltd., on the left hand of the picture—a very large and a very small moulding backed by a peep at a great press. Herein lies almost the whole story of a big enterprise.



From the large range made by Crystalate, Ltd., we select one speciality of special merit, which is finding much favour here and abroad. Yet another, a very modern transparent hair drier, we shall include in next month's issue. The flasks are made for British Vacuum Flask Co., Ltd.

As a tail-piece we include our very own stand, which also has some merit.

World's Industry Employs Plastics

GENERAL ENGINEERING

Compound curvatures in plywood are resin-glued by the "Raytronic" high-frequency - heating process. A metal-sprayed coating serves as internal electrode. P. H. Bilhuber describes the process and its wide applications. ("Mechanical Engineering," 1948/Mar./213.)

Heat distortion.—L. S. Moody and K. B. Goldblum found a new interpretation for the heat distortion of plastics by plotting a graph of the log. of deflection against the log. of the absolute temperature. This shows a marked difference between the behaviour of thermoplastic and cross-linked materials. (A.S.T.M. Bulletin, 1948/Jan./55.)

Machine covers. — A transparent "Perspex" front replaces the sheet-metal covers previously fitted to hand-operated Sigma multi-inspection machines, by E. H. Jones (Machine Tools), Ltd. ("Modern Times," 1948/Mar./56.) The lens grinder of Impregnated Diamond Products, Gloucester, is also fitted with a moulded transparent plastic hood.

Fiberglas plastics.—A new 36-page booklet with up-to-date information on the properties of fiberglas-reinforced plastics, their range of applications, the economics of their manufacture and use, manufacturing methods and selection charts, has been issued by Owens-Corning Fiberglas Corporation, Toledo 1, Ohio. (Review in "Mechanical Engineering," 1948/Mar./246.)

Assembling technique.—For assembling transparent plastics it is suggested to hold the parts together with plastic dowel pins, which are fed into pre-drilled holes while quickly rotating. The pins become invisible since they weld into the adjoining material. After inserting, they are cut off flush. ("Popular Science," 1948/Mar./187.)

Synthetic rubber.—J. F. McWhorter compares natural and synthetic rubbers with reference to their properties, mechanical applications and economics in production, also discussing various modern applications. ("Machine Design," 1948/Feb./138.)

MISCELLANEOUS

Endless belts.—The "Fuse-ite" plastic belt (Jules Borel and Co., Kansas City, Mo.) is used extensively in the Swiss watchmaking industry. An endless belt is obtained by bringing the two ends together under heat. Greater wear resistance is claimed than with other belt materials. ("Canadian Machinery," 1948/Feb./112.)

Brushes.—M. Duncan reviews the application of nylon monofil for industrial brushes, and stresses in particular the great chemical inertness of this material. ("Chemical Age," 1948/Mar. 20/394.)

Protective coatings.—A clear plastic protective coating "Mirofilm" (Wype Corporation, 2214 Dolman Street, St. Louis, Mo.), may be easily applied to metal or wooden surfaces with a clean lint-free cloth, and dries quickly. ("Products Finishing," 1948/Mar./118.)

Faceshield.—A lightweight, durable, plastic faceshield (American Optical Co., Southbridge, Mass., U.S.A.) has been

developed to be worn in connection with respirators. The outer edges of the shield have a vinyl plastic binding. ("Products Finishing," 1948/Mar./120.)

Electrical plastics.—G. Haefely reviews the growing importance of plastics in the electrical industry. ("Engineering Materials and Processes," 1947/Dec./154.)

New resins.—Two new resins of vinyl chloride-vinylidene chloride copolymers (B. F. Goodrich Chemical Co., Rose Building, Cleveland, 15) offer increased thermoplasticity and lowered softening point; they have tensile strengths of 6,875 and 5,885 lb./sq. in. and are recommended for piping and battery separators. ("Machine Design," 1948/Mar./169.)

Chemical plant.—A. I. Coleman refers to the use of sprayed plastics as corrosion- and abrasion-resistant coatings for chemical plant; polythene, p.v.c. paste, and silicones are also mentioned. ("Chemical Age," 1948/Jan. 10/47.)

Buna-N synthetic rubbers when mixed with polyvinyl chloride give highly versatile types of plastics. From 40 to 50 million lb. of these blends are being produced annually in America. Synthetic rubbers mixed with thermosetting resins not only toughen the product but increase the colour range and maintain good physical properties. ("Scientific American," 1947/Dec./266.)

New rubber stabilizer, described by U.S. Rubber Co., does not cause white products to darken when exposed to sunlight, neither does it stain white surfaces with which it comes into contact. Greater insulation is achieved by eliminating salt in the rubber-making process, thus reducing by 65 per cent. the amount of water absorbed by rubber. A new cross-linking agent produces a softer and more easily handled type of synthetic rubber. ("Autom. Industries," 1947/Nov. 15/67.)

Mould cooling.—A heat-reclaiming system for recovering the heat taken up by the cooling water from plastic moulds is discussed by S. C. Darling. ("Mech. World," 1948/Jan. 23/102.)

Plastic foils.—G. Kroker discusses the use and control of plastic foils used in the construction of electrical machines. With high demands in respect of thermal qualities, only a limited number of materials are available, amongst which cellulose ester foils, in particular, have proved satisfactory. ("Kunststoffe," 1947/Oct.-Dec./221.)

Radio receivers.—Transparent radio receiver case by Triplex Safety Glass Co., Ltd., allows the inner working parts of a wireless set to be seen." ("Mass Production," 1947/Nov./70.)

Polyamides.—A survey of patents on the production and application of polyamides is given by K. Fabel, excluding applications in the textile industry. The subject matter is classified under production and treatment of films, moulding and diecasting materials, use of moulded components, solvents and plasticizers, cements and lacquers. ("Kunststoffe," 1947/Oct.-Dec./197.)

Phenolics.—Studies on phenol-formaldehyde resins by W. Hultzsch deal with the heat- and acid-curing of phenol resins and the structure of acid-cured resins. ("Kunststoffe," 1947/Oct.-Dec./205.)

SOURCES OF REFERENCE

We wish to remind readers that the sources of reference from which these pages are compiled are not, in general, retained in this office. We cannot, therefore, undertake to supply such originals. Nevertheless, most of the foreign journals referred to are available in the Patent Office Library (Southampton Buildings, Chancery Lane, W.C.2) and in the Science Library (South Kensington). Photo-duplicated copies of articles may be obtained from the Photostat Dept. of the Patent Office.

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

QUALITY CONTROL.—The British Standards Institution state that B.S. 600, "Application of Statistical Methods to Industrial Standardization and Quality Control," has now been reprinted. This standard explains why a statistical technique is needed for the solution of problems of specification, standardization and routine process control. Specimen problems are discussed to introduce the common statistical measures. Questions of sampling are also examined and guidance on sampling is given. Methods of controlling the quality of a product either by examining samples taken from batches, or consignments, or by routine testing in the course of manufacture are described. Copies are obtainable from the British Standards Institution, 24, Victoria Street, London, S.W.1, or their sales agents in oversea countries, price 12s. 6d.

EXPORT PROMOTION DEPARTMENT of the Board of Trade (with the exception of the Exhibitions Branch) has moved from 35, Old Queen Street, S.W.1, to Thames House North, Millbank, London, S.W.1. The telephone number (Victoria 9040) remains unchanged; telegraphic address is altered to "Advantage, London."

INDUSTRIAL SOLVENTS.—The 1948 edition of "Bisol Organic Chemicals" reflects some of the developments which were foreshadowed by the announcement early in 1947 of the authorization of £2,000,000 new capital expenditure at the Hull works of British Industrial Solvents, Ltd. This new edition gives specifications and properties of more than 80 products of fundamental interest to chemical manufacturers. The "Bisol" range, which comprises alcohols, aldehydes, acetals, ketones and esters, is being widened to include methyl ethyl ketone and methyl isobutyl ketone, and also a number of the newer alcohols and esters, such as methoxy-butanol and acetoacetanilide, diallyl phthalate and methyl acetoacetate.

DE LA RUE INSULATION, LTD.—Mr. E. A. Davis has been appointed to the board of De La Rue Insulation, Ltd., and now becomes technical director. Mr. Davis has been associated with the De La Rue group since 1919. Another newcomer to the board is Mr. W. F. Campling, who has been appointed works director. Mr. Campling recently resigned from the County of London Electricity Supply, and associated companies, after 23 years' service.

HALEX, LTD.—Princess Elizabeth paid an informal visit to the Hale End factory of Halex, Ltd., on March 31. Accompanied by the Lady Margaret Seymour and Mr. John Colville, she was conducted round the works by Mr. C. F. Merriam, the chairman of the company, and by H.M. Chief Inspector of Factories, Mr. Barnett, who indicated points of interest regarding safety precautions.

TRANSART, LTD., whose process of printing trade catalogues and related literature on leaves of transparent plastic was described in "Plastics," April, 1948, page 196, have now removed to 39, St. James's Street, London, S.W.1.

MR. CLAUDE DIAMOND, B.Sc., F.R.I.C., has left the service of Courtaulds, Ltd., after being with that company for over 28 years. He will in future practise as an independent consultant. His present address is 54, Northumberland Road, Leamington Spa, Warwickshire. (Phone, Leamington Spa 1189.)

B.I.F. EARLIER CLOSING.—Owing to the incidence of the Whitsun holiday, the British Industries Fair, both in London and Birmingham, will close at 4 p.m. on Friday, May 14, instead of at 6 p.m. as previously announced.

NOTES FROM THE BRITISH PLASTICS FEDERATION

Manufacturing Restrictions

As a result of representations by the Federation, an amendment to S.R. and O. 1176 (1945) has been issued. The effect of this amendment—The Miscellaneous Goods (Prohibition of Manufacture and Supply) (No. 11) Order, 1948, Statutory Instrument No. 585, 1948—is to allow the manufacture of plastic cups and saucers, mugs, beakers, mirrors and babies' pushers, without restriction and in any colour, from April 1, 1948.

Maximum Prices

The Federation has made representation directly to the Board of Trade, and in co-

operation with the F.B.I., regarding the Miscellaneous Goods (Maximum Prices) Order, 1948, No. 348. As a result of these representations, modifications have been made that are of direct benefit to the moulding and fabricating branches of the plastics industry.

Bowen Prize Fund

In order to allow more time for the submission of entries for the Bowen (Cables and Plastics) Prize Fund, the closing date will now be June 30.

PLASTIC INSTITUTE NOTES

New members.—Recent elections to the Fellowship of the Plastics Institute include Mr. C. R. Williams, works director of Birkbys, Ltd., Liversedge, Yorks.

Training Grants.—The trustees of the President's Fund of the Plastics Institute invite applications from young men or women engaged in the plastics industry, born between August 1, 1929, and July 31, 1930, for a limited number of training grants of £100 per annum for one year to cover all expenses, including tuition fees, which may be increased at the discretion of the committee in special cases, the onus being upon the candidate to find a suitable college. These grants are for full-time courses of one year's duration. Applications must be submitted to the Managing Secretary, The Plastics Institute, Adelphi House, Adam Street, Strand, London, W.C.2, not later than May 31, 1948.

Prize Papers Competition.—With a view to encouraging the younger personnel of the plastics industry, the chairman and committee of the London Section recently arranged a competition for short papers, not exceeding 1,500 words, on any subject within the scope of the industry. The upper age limit for entrants was 25 years.

The adjudicators report that, whilst the standard of the papers submitted was not high enough to warrant the award of a first prize, they have every confidence that an improving standard may be looked for in future competitions. The following awards, however, have been made:—

Two second prizes of 3 guineas each to Mr. D. O. Newling, employed by Insulators, Ltd., Edmonton, N.18, for his paper on "Standardization in Design and Manufacture of Moulds and Mould Equipment for Plastics," and to Mr. L. R. Davenport, employed by Clang, Ltd., Cricklewood, N.W.2, for his paper on "Design of Multi-impression Mould Tools."

The third prize of 2 guineas to Mr. A. M. Cottrell, employed by Stanley Smith and Co., Ltd., Isleworth, for his paper on "The Manufacture of Thermosetting Synthetic Resin Adhesives for Wood."

Two consolation prizes of 1 guinea have been awarded to Mr. J. B. Hanger, an apprentice engaged by I.C.I. Plastics Division, for his paper on "Injection Moulding of Thermoplastics," and to Mr. E. A. Applebee, employed by The Telegraph Construction and Maintenance Co., Ltd., Greenwich, S.E.10, for his paper on "Design of Short Run Injection Moulds for Thermoplastic Materials."

The winners are being asked to select books to the value of their respective prizes.

Aesthetics.—Through stimulus received from the Ministry of Education and from the Council of Industrial Design, the Education Committee of the Plastics Institute has instigated summer day-time courses in "Aesthetics," with the co-operation of a number of technical colleges throughout the country. These lectures, six in number, each of two hours duration, will be held between May and July at the Birmingham Central Technical College and the Borough Polytechnic in London; also, it is hoped, in Manchester and Cheltenham. Should the trial courses prove satisfactory it is proposed that they be put into full-scale operation in 1949, with the subject of aesthetics embodied in the Associateship and Diploma courses of the Institute.

The object of these courses is not to train students as designers in the plastics industry, but to give an appreciation of colour, texture and form, and an understanding of the differences between good and bad design.

The lectures on aesthetics and industrial design still to be given on Tuesday afternoons (2.15) in the School of Industrial Design at the College of Arts and Crafts, Margaret Street, Birmingham, to students of the Department of Plastics in the Central Technical College, are as follows:—

"What is Industrial Design," by A. Edward Harvey (May 25).

"Product Design in Various Materials," by J. Barnes (June 1).

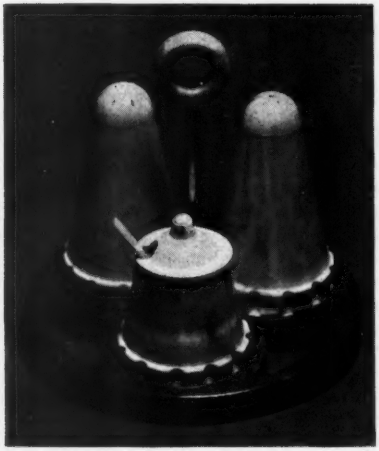
"How the Industrial Design Consultancy Functions," by J. Barnes (June 8).

"Form in Various Materials," by R. G. Baxendale (June 15).

"Colour," by E. R. B. Smethurst (June 22, at 3.30. p.m).

"The Industrial Design Consultant and the Staff Designer," by A. Edward Harvey (June 29, at 2.15 p.m.).

New Productions from the Moulding Shops



Cruet in Polythene

This complete cruet set is made of polythene, and is a production of Tamworth Plastics, Ltd., of Alders, Tamworth, Staffs. It includes a mustard pot which is considered to be of excellent shape, and appropriately shallow to avoid waste, remembering the need for mustard always to be freshly made; in this use, polythene appears to be particularly suited.

Memo Stamp

The "Emgee" memo stamp, here illustrated, is by Gutteridge, Sampson and Co., of 151, Farringdon Road, London, E.C.1. It is a self-inking affair which operates in conjunction with a stencil of specially prepared paper. The body, conveniently shaped to fit the hand, and also housing the inking device, is moulded in black phenolic, and has retractable feet which permit it to be freely placed in position before being depressed.

Cocktail Mixer

Black and white "Perspex" has been employed for this cocktail mixer, which is not only intended to be attractive when standing on the bar, but also stresses a generally clean appearance. Fabricated by Glaz-Lite, Ltd., of 140, Hoxton Square, London, N.1, the overall height is about 18 ins. It will be observed that the electric motor is enclosed in a spherical casing, and that a clamp of elaborate yet convenient shape (also made entirely of "Perspex") is provided to hold the metal receptacle in which the cocktail ingredients are mixed.

Welded "Perspex" Tubing

Erolite Plastics, Ltd., 325, Latimer Road, North Kensington, London, W.10, have recently started to manufacture welded clear "Perspex" tubing and are now specializing in this product. Inquiries have been received from such diverse concerns as breweries, manufacturing chemists, aircraft engineers, dairy engineers, makers of chlorinating plant, makers of photographic apparatus, the Metropolitan Water Board, and a large brick company.

Quality Control in Plastic Moulding—VI

By W. M. HALLIDAY

Following the discussions in the instalment published last month, the author here describes useful ways in which the control charts can be employed to cover the special circumstances arising when a number of successive production runs, each of very short duration, are required from a hand-operated mould.

Main consideration, however, is devoted in this article to the manner in which the simple forms of quality control charts and inspection procedures, as previously explained, may be successfully applied to production from semi- or fully automatic injection moulds.

Special attention is given to the various points of departure inherent in the two distinctive methods of plastics moulding, viz., compression and injection, noting in what degree or manner such differences affect the evaluation, construction and application of the charts so far described.

THE articles previously published in this series have described and illustrated in some detail the general statistical basis underlying quality control procedures, and in particular how such inspection procedures can be applied to cover component inspection operations in connection with a very simple type of portable, manually actuated, compression moulding tool.

Very descriptive illustrations have been given of the various preparatory steps required in order to construct reliable control charts. Summarizing very briefly those important steps it will be found that they must comprise the following matters, which, of course, are essential as a preliminary to the setting-up of quality control methods in reference to any form of plastics moulding.

First, sample and truly representative production data must be obtained from trial operations on the mould in question, which trials should be of adequate duration to give reliable results. These trials are essential in order to determine for the production moulder a number of highly important points.

Chief of these will be whether or not the mould is capable of producing components to the required degree of dimensional accuracy; with uniformity of configuration over reasonably sized batches; an acceptable quality of surface finish, density, or weight; and at a sufficiently high rate of output to render the production economical or reasonably in conformity with the estimated price associated with the job.

These matters are obviously highly important to the production engineer and mould designer, and usually such requirements will call for satisfactory solution at the very outset to any plastics moulding operation immediately after the mould has been tested and proved in readiness for starting the production.

It very frequently happens with both compression and injection-type moulds that owing to some deficiency in original design, construction or methods of operation of a new moulding tool, components to the requisite standards or limitations stipulated by the client cannot consistently be produced.

With customary methods of component inspection, such as were outlined and commented upon at the very beginning of this series of articles, it is very easy for such an inadequate form of mould to be passed forward to the normal production usage, with the ensuing day-to-day production characterized by an excessively high rate of defectives or even scrapped mouldings.

It is easy for such a high percentage of faulty parts to be regarded as normal to the production, simply because at the outset no thorough-going tests were made to discover whether or not the mould was capable of producing mouldings to the required accuracy or speed.

The making available of such information as the foregoing will, of course, prove extremely helpful to the production engineer for guiding him on these essential points. For example, possession of such precise information will enable him to judge whether the mould should be passed for production use, or whether modifications are required to improve its accuracy, ease of operation or some other feature.

This information will also enable him to determine with some precision the *total proportion of faulty or wrong-sized* moulded components to be expected from any given production batch quantity. He will also be in a position to say with close accuracy the *maximum amount of deviation* in component sizes or other features. Thus, not only will he be in a position to assess the total volume of defective parts from a given production run but also the extent of the fault on each component.

Such information, if secured at the very beginning of a particular moulding project, will materially guide the production moulder to secure the most economical manufacture, since he will know beforehand with reliability, scrap percentages and the amount of corrective work which will be involved.

Secondly, by obtaining the data necessary for control chart compilation it will be possible for the production moulder the more easily to determine the most appropriate or efficient method for operating the mould. This will usually result in the development of a completely adequate set of operating rules and instructions for the guidance of the person who will have to handle the mould during the day-to-day operations.

As most plastic moulders will be aware, this question of the issue of proper operating instructions is extremely important, especially in the case of portable or manual-type compression tools.

Often a new mould may be completed, and tested satisfactorily, afterwards, being issued for production use with the most meagre instructions or guidance afforded to the mould user. This may result in the operator starting off in the wrong manner, causing inferior mouldings to be produced, or an excessively long time to be taken in their manufacture. Sometimes, too, damage may be inflicted to the mould itself due to such inadvertent improper handling or operating of the tool.

Thirdly, with all the above-mentioned information made accessible in the manner just described, the production moulder is then able to construct the necessary control charts or graphs needed to facilitate the inspection of the moulded products as they are being produced during normal production.

Advantages from Application of Quality Control

From the descriptions and illustrations surrounding the introduction and continued application of quality control methods to the typical manual compression mould considered, readers will no doubt have appreciated some, if not all, of the numerous valuable advantages derived.

Contrasting these advantages with those to be claimed for customary and more orthodox forms of component inspection, it will help to guide readers if these are here enumerated. They are as follows:—

(1) Quality control procedure, it will be noted, serves as a very valuable complementary check to usual gauging and inspection methods by directing the attention of both inspectors and mould setters to undesirable working or operating conditions, as and when these develop.

(2) It will be understood that such attention is focused at a sufficiently early stage during production of the moulded article to obviate, or at least considerably lessen, the risk of manufacturing unduly excessive quantities of defective parts.

(3) This salutary focusing of attention at the onset of developing faults will also serve to effect a marked improvement in the accuracy, surface finish, and general

quality of components in any given batch production.

(4) It also brings the inspection activities sufficiently close to the moulding operation proper to prevent serious errors, in either the moulded component or the mould itself, developing unnoticed by someone in authority.

(5) Quality control in the manner described will also increase the ability of the inspector and mould toolmaker to determine not only developing faults or errors in respect of the moulded component, but to ascertain more readily the cause, and the exact nature of the mould errors.

(6) Because developing faults will usually be discovered at a very early point before they have reached serious proportions, there will be far greater likelihood of detecting and correcting the mould faults giving rise to such errors, before those faults assume a serious nature.

(7) Inspection operations will be very appreciably promoted by rendering it possible to maintain an effective check upon the quality of the moulded products without recourse to 100 per cent. inspection of *every moulding*. In many cases inspection costs can be reduced substantially purely on account of this lessened requirement.

Increased Confidence of Inspection Staff

(8) Another worth-while advantage gained from inspection procedures based on quality control is the increased degree of confidence imparted to the inspection staff generally. Where quality control methods have been inaugurated it will speedily be found that an inspector will not hesitate to stop a moulding operation solely on the evidence afforded by the control charts. By means of such pictorial evidence that some non-permissible variation has arisen in respect of the working conditions all uncertainty, arguments, or protracted discussions as to whether such-and-such components could be passed or rejected will be completely obviated.

Should the plotted points on the control chart indicate some development causing the product to pass out of control, production must be stopped for investigation of the mould to discover the cause, since the inspector will know *positively that defectives are about to be, if not actually, produced.*

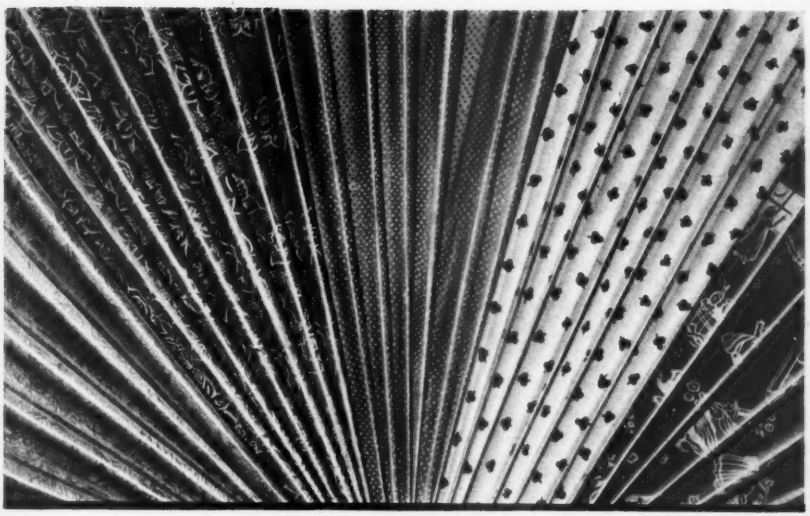
(9) A further valuable advantage to be noted is in connection with the building-up of a set of important operating data concerning each particular moulding tool. Taken over a substantial period of time, this will afford both the designer and the production moulder very helpful guidance as to the capacities and limitations of each mould, its tendencies to error, and general ability to produce reliably accurate mouldings.

This information will prove particularly useful to the mould designer because of the guidance it ensures when new mould designs are under consideration. By means of this accumulated experience recorded on the control charts, unsatisfactory features giving rise to operating snags can be more easily detected and their adoption avoided in the case of new mould constructions.

(10) The methods of quality control, as described earlier, are applicable for production either from single- or multi-impression moulds. Moreover, these may be either hand-operated, as in the case of the example already dealt with, or entirely automatically operated types.

(11) Furthermore, quality control methods can be applied to the inspection of mouldings where important features other than their dimensions have to be held within specified limits of variation. Thus surface finish, weight, uniformity, and other similar features can be readily controlled.

(12) It also permits the works supervisors, whilst passing through the moulding shop, to discern practically at a glance exactly in what manner each particular mould production is being performed as regards accuracy of the products. Thus the production engineer, by simply taking note of the growth of the control chart for each mould in use, will be able to observe the trend of the



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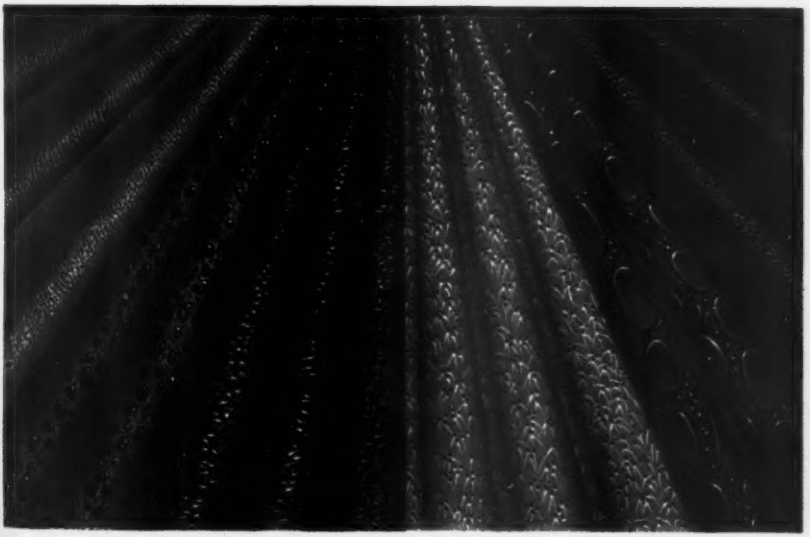

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plotted points thereon, seeing if they fall well within the respective datum lines. In this manner he will be able to tell whether production is tending to pass out of control, or remaining stable.

This is obviously a great improvement upon what takes place under conventional forms of component inspection. Should the production engineer wish to ascertain the tendencies or progress of moulding operations under these methods it will be necessary for him to wait until a given batch quantity of components produced has been checked and perhaps each part measured or gauged.

(13) Increased moulding production is also often the result, due to the fact that the quality of the product has been improved, or is more easily held within a given range of variation. The method of quality control inspection nearly always results in an improvement of handling and using methods of the manual mould, partly because the operator will be correctly instructed in its use at the start, and partly because he will have a pictorial presentation of the vagaries of production and the quality of output, which will serve to indicate to him the occurrence of untoward deviations calling for correction.

These, then, are some of the chief advantageous features to be observed as generally resulting from the application of quality control inspection methods, and before leaving the subject of the control of a hand-operated compression tool one further interesting point remains to be dealt with.

Control of Short-run Moulding Operations

It may be asked what procedure is to be adopted in regard to the quality control of a production run from a mould when this run has to be of a necessarily short duration.

With many hand-operated portable compression tools having one or only a few impressions, the mould design has been specifically selected because the batch quantity of parts on order may have been very small, or the price factor for the whole job may be very low, thus precluding the use of a more intricate and expensive moulding tool.

In these circumstances it often happens that such a mould may only be placed into production use for two or three days at a time, so as to complete relatively small quantities on occasionally repeating orders.

To meet such needs it is sometimes necessary to modify the quality control charts applied to the job, and at this point it will prove useful to describe what course may be usefully adopted.

The specimen charts so far illustrated and described have been arranged for covering at least one whole working week of production for a given mould. In some instances it may prove advisable to arrange for the charts to deal with production runs of even greater duration. This can often be easily performed without resulting in a size of chart too large to make for convenient handling by the inspector.

In those cases, however, where the period of usage of the mould is considerably less than a week, the following practice will be found helpful: A sufficiently large chart would be provided having spacings for plottings and other information to cover three or four such short production runs. During each individual run the charts would, of course, be plotted in the manner already fully explained. Upon completion of such a run, however, the charts should be filed carefully away, together with all other relevant information concerning the order, and kept against the time when the same quantities of parts arises in a repeat order.

At the next set-up of the mould for the repeat order the charts would then be reissued and continued as before. This would mean that instead of dividing up the lower horizontal datum of the charts into spacings corresponding with days of the week, a greater number of spacings would be provided. Each of these would be left blank, so that the inspector, when commencing a new production run,

could fill in the date underneath each spacing. In this manner the charts would suffice for a number of similar production runs, and yet each set of control plottings could be readily identified by referring to the date inserted by the inspector.

When preparing the control charts, incidentally, the sample sets or groups of components upon the variations of which the "production characteristic," "sample means," and the other highly important data is based, would have to be ascertained in relation to quantities much larger than any single production run to be required.

By adopting this method of using the charts paper work will be kept to a minimum amount. This might prove a considerable saving in cases where a number of such moulds are in regular use.

The inspector and mould setter will also have placed at their disposal during any particular production run a pictorial presentation of the features associated with the previous run, which would illustrate for their guidance any variations occurring and likely to be repeated at the succeeding use of the mould.

Considerable instruction may also be afforded by charts, when employed in this manner, upon the behaviour, capacity and limitations of the moulding press in conjunction with which the mould is used.

By acquiring the kind of information embodied in the control charts adapted in the above manner for short-run production, it may be revealed from time to time that certain errors or faults recur with undue frequency. Investigations might then show that such errors, etc., arise because of certain limitations or minor defects in the press, which otherwise might not be so easily revealed.

Incidentally, the author has found this to be a most important point, particularly in reference to compression moulds; to illustrate more clearly its importance to both the mould setter and the designer, the following example is quoted.

With one particular hand-operated compression mould from which only short-run productions were required, certain operating snags which constantly recurred were found to owe their origin to a number of defects in connection with the moulding press.

On one dimension the moulded article had to be maintained to certain close limits. It was found as a result that the press was really unsuitable for producing these parts due to serious misalignment of the platens. This allowed the mould blocks to be improperly closed, entailing excessive flash formation at one portion of the moulding, and consequent loss of accuracy at that part.

When the mould was transferred to another press of better construction and improved accuracy no further troubles were encountered in respect of the dimensional variations formerly noted. This is just one interesting way in which the use of a quality control charting procedure can assist in revealing at an early stage deficiencies or unsuitabilities of the press, or methods of using same.

Quality Control for Simple Injection Moulds

It should be understood that whilst the quality control procedures so far described have related to a compression type mould of the hand-operated kind, in the main they can also be applied with equal success to control the output from semi-automatic or fully automatic injection moulds.

Naturally, before such applications can be made it may often be necessary to effect certain modifications to the construction and form of control charts employed for such purpose.

In view of the wide variety of injection-mould designs now extensively employed, it is proposed to devote a little preliminary consideration to the matter so as to indicate to readers the nature of such modifications required, and their underlying reasons. An opportunity will also be taken for noting the advantageous effects accruing from an adoption of quality control methods for injection-type moulds.

Differences Between Injection and Compression Moulding

To begin with, it is desirable to observe the effects of certain specific differences in technique between compression and injection moulding because these will determine the kind, and extent, of the modifications to the control methods, and charting facilities. These fundamental differences are:—

(a) In marked contrast to compression moulding, that of injection is extremely rapid. This is due to the fact that the material is powerfully injected into the mould in a plastic condition, and does not require time for "curing" within the mould.

Thus the material may be injected and the moulds opened practically immediately afterwards for ejection of the quickly solidifying component. This is one of the chief reasons making for very high rates of output from the injection process.

(b) The injection-moulding process is also one highly conducive to the use of multi-impression moulds, this being yet another advantageous feature making for high speed of operation of the mould and injection machine.

(c) Usually in injection moulding, because the material is heated up to a plastic state *externally to the moulds*, considerably less pressures can be employed on the material than is the case with compression moulding.

Thus the mould is not subjected to the excessively high compressive pressures, and resultant strains. For this reason, therefore, it is possible to maintain somewhat finer limits on an injection-moulded part, and to secure greater dimensional uniformity over large numbers of successively produced components.

It must also be remembered that the injection type of mould can usually be worked at a considerably lower temperature than its counterpart in compression moulding. This, of course, means that the mould shrinkages can be much more easily controlled and correctly maintained over long production runs.

A further point worthy of notice associated with this question of lower working temperature is that mould operation is facilitated and its length of working life is increased.

(d) It has to be remembered, however, that many injection moulds are of very complex construction, entailing elaborate core-drawing arrangements, application of inserts, the formation of slender sections, or the moulding of extensive surface areas of very thick cross-section.

All these and kindred features on an injection mould will, of course, very importantly affect the manner in which it has to be used, its speed of operation, ability to produce mouldings to required accuracy, and, generally, its length and quality of working life.

(e) Injection moulds are usually designed to involve much less purely manual actuation than compression moulds.

This is an important factor often very drastically controlling the entire manipulation of the mould. To begin with, the mould blocks are positively mounted on the injection-machine platens in predetermined positions, which they occupy undisturbed throughout the entire production run. Then again they have not to be partially dismantled after each "shot" in order to extract the finished component, etc., as so often is necessary with compression moulds, especially those of the "split" type.

All these important features which are essentially connected with injection moulds very materially determine the kind of quality control charts which can be employed, and in the next instalment the author will describe and illustrate how such modified quality control procedures, etc., are arranged and successfully applied on both semi- and fully automatic-injection moulds.

(*To be continued.*)

Electroformed Moulds.—P. Spiro discusses the production of electroformed moulds for plastics and die castings in a paper, which has been reprinted, together with the ensuing discussion, in "Electroplating," 1948/1/256.

The Microscopic Examination of Plastic Materials

VII.—Mouldings (Contd.)

By J. H. WREDDEN, F.R.M.S.
(Chief Chemist, Igranic Electric Co., Ltd.)

FROM the information obtained regarding the factors affecting resin penetration into the vessels of the shive particles, it will be seen that the question of promulgating statements regarding the mechanism which operates against it is almost insoluble—in the light of knowledge at present available—as the ultimate effect produced by the behaviour of so many variants, and the manner in which they interact, is not readily capable of being placed on a mathematical basis. A similar problem presented itself in the study of varnished sleevings.

Another curious effect to be seen in the flax shive-filled moulding is the behaviour of the resin itself, which appears to craze or crack badly in certain locations in the structure. This seems to occur on, or close to, the surface of fairly large particles of filler. Such a site is shown in Fig. 286, which shows the surface of two particles where this has occurred. The level of the focal plane is somewhat below the level of the surface of the section, so that in effect we are viewing an internal plane in the structure of the material. The illustration, at a magnification of 100 diameters, clearly shows numerous cracks at the surface of the resin grouped at points "A," where they are most noticeable. It is difficult to put forward a reason for the appearance of these cracks as they are somewhat unexpected, but it can be suggested that they are akin to the type of crazing one would expect in an unfilled resin which had been rapidly cured, and it is quite possible that it might happen in the case of a filler particle which is relatively inelastic; thus, if we imagine a filler to be composed of large particles of silica of a similar size to those depicted, then the contraction of the resin mass would not be relieved by a similar contraction of the filler particle and a crazing of the resin at the matrix. Particle interface may be expected and, indeed, it is probable that this would extend into the resin for some distance around the particle. The case of the silica particle, of course, illustrates the circumstances most calculated to bring this about and the result is reasonably certain, if not a foregone conclusion, although it must be borne in mind that the degree to which crazing will occur is dependant upon the size of the particle, the larger the particle the more favourable being the conditions for crazing.

In view of this, the appearance of crazing around a particle of the nature of flax shive is unexpected, to say the least of it, as the material being cellular in construction is capable of a degree of compression greatly in excess of the contraction exhibited by the resin. Therefore, one would expect that as the resin contracted the particle would do likewise to its full extent; in this way the stress in the resin would be satisfied and crazing prevented. However, this is quite obviously not the case with these large flax shive particles, and would appear to be due mainly to their size.

To revert to our example of the silica particle, if we imagine that instead of one large particle there are a large number of smaller particles, then one would not expect bad crazing of the resin, if at all, due to the contraction stresses being more evenly distributed through a larger

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Fig. 286.—Section of flax shive filled moulding showing large cracks in resin. Mag. 100 diameters.

Fig. 287.—Flax shive filled moulding showing cracks in resin at higher magnification. Mag. 340 diameters.

total scheme. The situation now becomes one where a large number of little units are each carrying a small portion of the total load imposed by the contraction, thereby avoiding the high concentration of stress in one spot, as experienced by the large particle.

Thus it would appear that in the case of the large shive particle, the stress concentration is so great as to avoid to some extent the contractile properties of the particle, and crazing results. This contention is supported to some degree by examination of a section which shows this type of crazing only in association with these large particles, and although some of the medium-sized units do show a small amount of crazing, none can be detected in the case of the small units. The crazing shown in Fig. 286 is of a more or less regular pattern, being mainly at right angles to the direction of the vessels in the particle, but this is by no means universal, as the crazing on the smallest particles showing this phenomenon does exhibit somewhat different characteristics.

Fig. 287 presents the cracked resin surface around one such unit, at a magnification of 340 diameters. This illustration shows that the crazing takes place mainly in a direction parallel to that of the vessels. These vessels appear in the photograph between the limits indicated by the letters A, B and C, and it will be noticed that large cracks in the resin are apparent at the places where one vessel lies against the next. They appear to occur along the line of contact of these latter, due, no doubt, to the presence of the inter-cell cement substance, which in this case is ligno-cellulose in contrast to reactive lignin to be found in substances like coconut shell. Whether this is the true reason for the cracking in this case, or whether it is mechanical in effect, as previously suggested, or a combined action of both, however, is not yet established.

There will be seen to exist in this example much smaller cracks at right angles to the large ones, the effect being to produce a network or reticulum, which must inevitably produce a very weak structure in the resin, leading to a gradual break-up of the resin under the influence of successive impact shocks. In view of this, it is suggested that a moulding, when subjected to shocks of this nature, repeated at high frequencies, would soon show evidence of any internal crazing around large particles, if it existed; and even if there were no crazing to commence with, it is highly probable that a list such as this would be sufficient

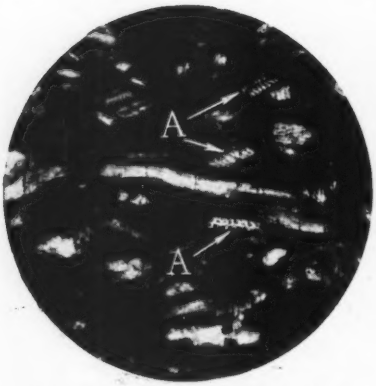


Fig. 288.—Section of moulding filled with beechwood flour: general view of smaller particles. Mag. 40 diameters.

Fig. 289.—Moulding filled with beechwood flour: general view of larger particles. Mag. 40 diameters.

to initiate crazing in any areas of high stress concentration, which would lead to a gradual disintegration of the resin matrix and finally of the moulding. It is suggested, therefore, that a list such as this, involving the time taken for a standard list piece moulded under given conditions, would perform a useful function in the assessment of the utility of fillers.

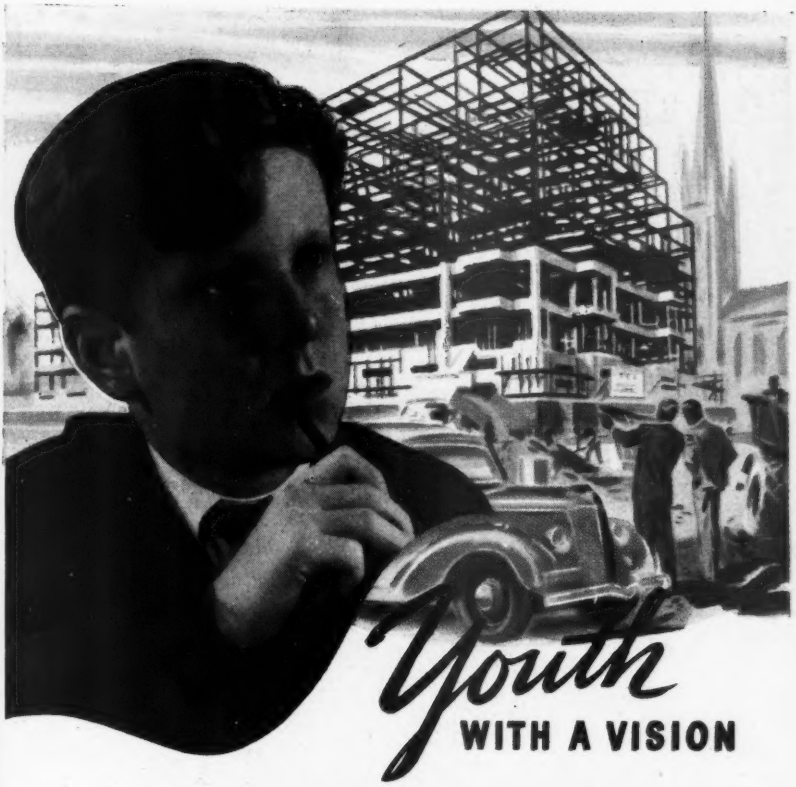
However, this crazing phenomenon, although abundantly evident in the case of flax shive, might not exist to such a great extent—if at all—when other fillers are used, and in view of the aforementioned possibility, that it is due to mechanical factors on the whole, one would expect that filler particles of a softer nature would in all probability produce this to a greater extent, assuming the speed of cure of the resin, and the other contributing factors, remained the same. However, a variation of one sort or another is rather to be expected than otherwise.

We will, therefore, leave this material and continue with the general examination of another, filled with beechwood flour, this material being made up in the same way as that previously examined and the same proportions being used.

The section about to be examined was taken from approximately the same place in the test piece; thus an endeavour was made to keep the conditions under which the section was prepared as constant as possible. In general, at low magnification, this beech filled material shows certain characteristics which might lead one to class it as being the same as that previously examined. In Fig. 288 we see a section at 40 diameters, a cursory examination of which shows a similar structure to that encountered with flax shive.

The particles marked A, for example, bear a resemblance to the shive particles in transverse section, and at this magnification it is impossible to make a definite statement regarding their origin, although the size of the vessels and the almost rectangular shape might lead one to suspect that the filler is a wood material of one type or another. At the same time, it will be noticed that whereas there is a distinct tendency to horizontal orientation of the particles, though it is not so strongly marked as in the case of the shive filler. This illustration shows a portion of the sections containing mainly the smaller particles of the filler, and points to the lack of order in their distribution in as much as their position relative to one another is concerned.

This particular filler, on the whole, does not exhibit such a great diversity of



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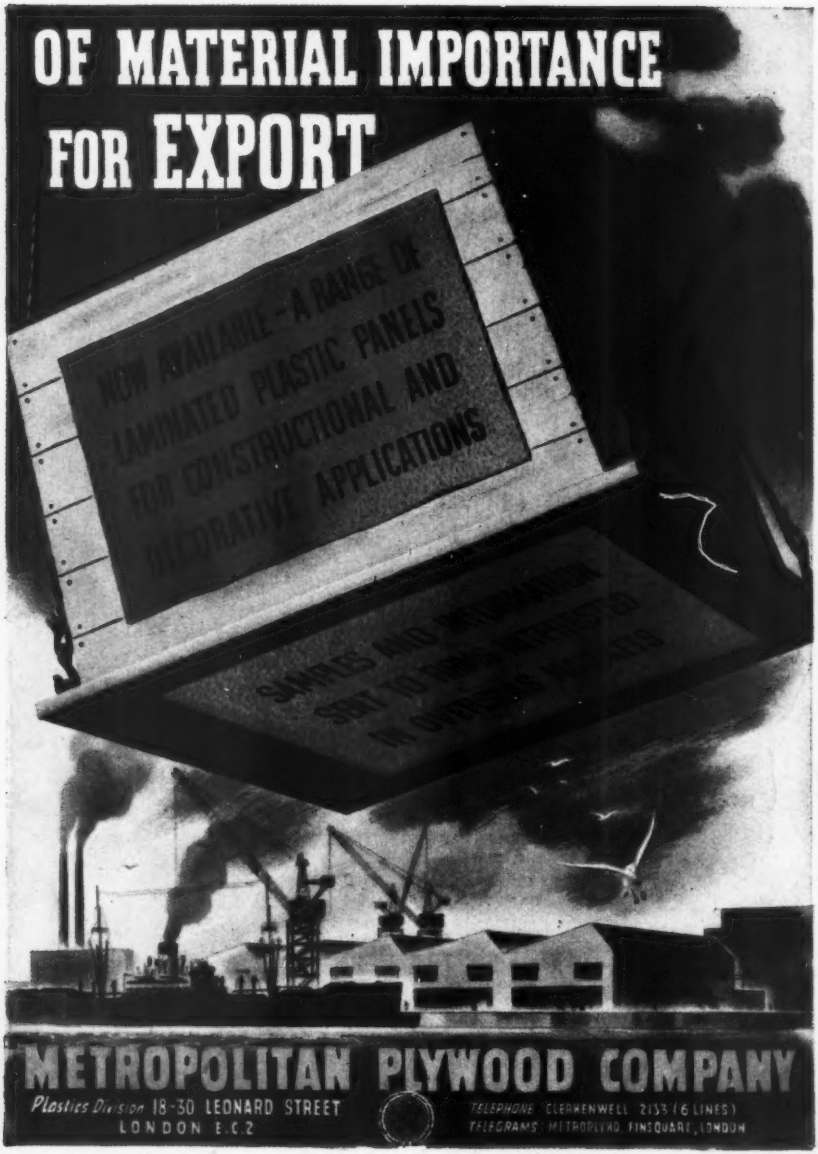
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particle size as was encountered in that examined previously, although the presence of a few particles which are larger than the average is plain to see. There is, however, an appreciable percentage of particles which appear to be of a different nature from the filler in general. Some of these are seen at A in Fig. 289, showing another portion of the same section at a magnification of 40 diameters. These are clearly not particles derived from beechwood, as the vessels may be seen to have very thick walls even at this magnification; therefore they must be the subject of further examination at higher powers.

Meanwhile, a general examination of Fig. 289 shows the structure of the material at this spot to contain more large wood particles than in the previous illustration. Three of these are seen at B, where it will be noticed that they are of large size and that they are very irregular in shape; in fact, one could not easily give a definite opinion as to shape. This is to be expected, due more or less to the indeterminate nature of the particle morphology seen during the examination of the flour in the raw state, and when it is considered that the particles in question have undergone the treatment involved in their incorporation into a moulding, then their present condition is not surprising.

Apart from this fact, there arises the question of the distribution of these particles, for it would seem probable that in this example the general structure consists of a fairly even distribution of the smaller particles (as in Fig. 288), with places here and there consisting of groups of larger particles. Why this segregation should appear in such a marked manner is not exactly clear, but it is possible that the reason might be found in their size, which would tend to limit their mobility during the generally turbulent conditions encountered in the early stages of the moulding cycle.

In view of this it becomes apparent that in spite of their limited mobility, this latter must exist to an appreciably greater extent than in the case of the large shive particles, which cannot have experienced

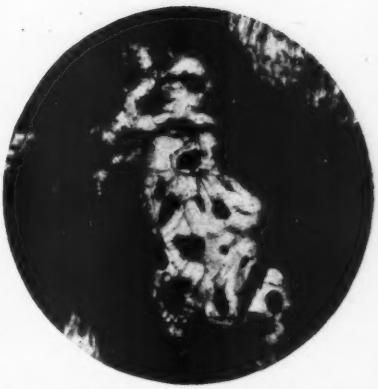

Fig. 290.—Moulding filled with beechwood flour, showing a particle which is not beech. Mag. 100 diameters.

very much movement, if any, otherwise we could not have expected the evidence of the existence of channels around them. It is certainly clear that if they had been capable of movement, the channels would either not have formed at all, or would have been less definite in nature, according to whether the difference of speed between the particle and the mass surrounding it was small or large. Therefore it would appear that, in general, difference in particle size is conducive to the production groups (or pockets) of particles of various sizes leading to a degree of segregation which would seem to be somewhat undesirable, in view of the possibility of creating areas of high stress concentration when the moulding is subjected to a load.

From this it will be clear that much depends upon the morphological characteristics of the filler itself. Thus a large number of fractions, together with a high variability index, if taken into consideration with greatly varying L.B. ratios, will inevitably tend towards the occurrence of a high degree of segregation leading to a generally lower strength for the moulding than if this were not so.

Having thus discussed the salient features of the section, it is proposed to return to an examination of the particles

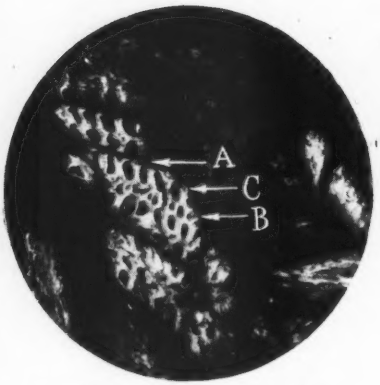

Fig. 291.—Beechwood filled moulding, showing large particle of beech. Mag. 100 diameter.

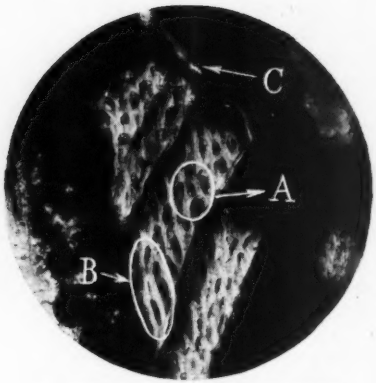

Fig. 292.—Beechwood filled moulding showing particle obliquely cut. Mag. 100 diameters.

first seen in Fig. 290. At that particular magnification it was clearly evident that these particles were composed of thick-walled vessels, but apart from this it was impossible to say whether they were beechwood particles or not. Thus a clear look at these elements is clearly indicated, and we see one illustrated in Fig. 290 at a magnification of 100 diameters. Here the particles exhibit a typical fibre structure with the fibre elements in transverse section. They will be seen to be more or less undamaged in spite of the treatment they have received. The bores are still quite open, and, what is more, are filled with resin.

These fibres are seen to possess very thick walls, still exhibiting the presence of pitting, and in some cases pit channels may also be detected. In fact, the general structure of this particle is distinctly reminiscent of that encountered in the coconut shell in transverse section, and one might almost be tempted to call it such. However, it is as well to bear in mind that most of the hard woods, such as beech, are typified by the presence of bundles of fibres in their structure, generally possessing very greatly thickened cell walls, and until the opportunity of comparing this particle with one from a known coconut-shell filled moulding presents itself, we are not justified in arriving at any definite conclusion regarding its nature.

During the examination of the flax shive filled moulding it was pointed out that, in view of the various aspects presented by the filler particles, their appearance was considerably modified in many cases, due to the section not being taken in one of the recognized planes. Several views of particles thus seen were shown, and in order that the investigator might thoroughly familiarize himself with the various aspects presented by beechwood, it is proposed to illustrate typical particles in section.

In Fig. 291 we see one such particle in true transverse section. It will be noticed that the vessels are somewhat collapsed, although not to the extent which might be expected in the circumstances. This is useful in as much as it is still possible to gain some idea of the shape and size of these vessels, even to being able to distinguish annular rings, the boundaries of which are clearly seen, one being indicated at A. The spring and summer vessels may also be distinguished, at B and C, by virtue of their size.

When particles such as that shown in Fig. 291 are seen in other aspects which indicate somewhat oblique sectioning,

they present almost characteristic appearances; one shown in Fig. 292, at a magnification of 100 diameters, has been thus cut. It immediately becomes apparent that in a case such as this one must be careful to interpret the image correctly, as the oblique sectioning is liable to lead one to assume that the vessels had suffered distortion in the processing. However, it is possible to ascertain definitely whether this be the case or not if the object is examined at different focal levels through its thickness, when it will be established that the upper ends of the bores of the vessels are displaced laterally to the lower ends. This displacement is, of course, proportional to the obliquity of the angle at which the section occurs, and by this means quite small differences may be detected.

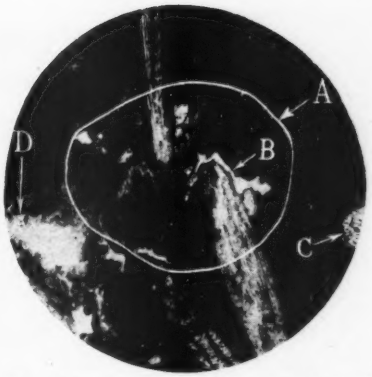

Fig. 293.—Beechwood filled moulding: view of large particle and fracture. Mag. 35 diameters.

Having established this point, the problem then resolves itself into one requiring the verification of the distortion due to pressure. As a rule, particularly with the hard woods, it will be found that where distortion occurs, it does so more towards the periphery of the particle, the vessels near and at the centre suffering little, except in the cases of small particles, where the forces are sometimes sufficient to make them unrecognizable. In the particles illustrated it will be seen that the vessels in the central group at A show no signs of distortion, whilst those at B, on the outer edge of the particle, are only too obviously squashed up. These facts, coupled with the accompanying defacement of upper and lower surfaces, furnish the information necessary before any conclusions can be drawn regarding the nature of the wood. The only evidence for this latter lies in the shape and wall thickness of the vessels, as seen in this and previous illustrations; in both cases one could say with certainty that they are hardened particles, as there is no evidence of rectangular thin-walled tracheids of the typical soft wood.

A crack in the section will be noticed at C (Fig. 292), which shows clearly how the matrix parts company from the particle surface in much the same manner as demonstrated with the flax shive filling. This tendency would appear to be fairly general in the case of this beechwood filling also, as will be seen in Fig. 293, an area of the section in which occurs a group of small cracks being at A. The most prominent crack in this field is seen at B, and here again it is evident that the fracture has occurred along the outer boundary of the particle in the same manner as in the previous illustration. The difference in this case, however, lies in the orientation of the particle concerned, which is seen to be in longitudinal section, so that it seems likely that this cracking occurs in this manner irrespective of the orientation of the particle relative to the direction.

It is desirable to point out, by way of interest, the bundle of thick-walled vessels seen at C. These are bast fibres found in the hardwoods and are typical of this type, as also the large space in the section at D, which was the result of a complete particle becoming dislodged and falling out.

Continuing our examination of ruptures in this beechwood-filled section, Fig. 294 shows a particle of beechwood in a somewhat oblique section to the true transverse. It will be seen that two of the medullary rays are included, but

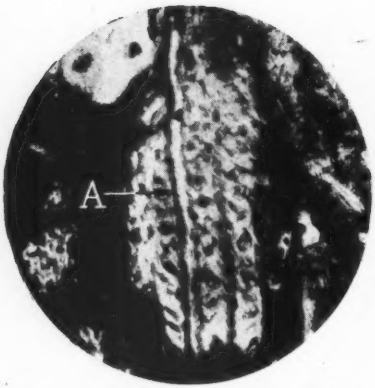

Fig. 294.—Beechwood filled moulding, showing fractures through particle. Mag. 100 diameters.

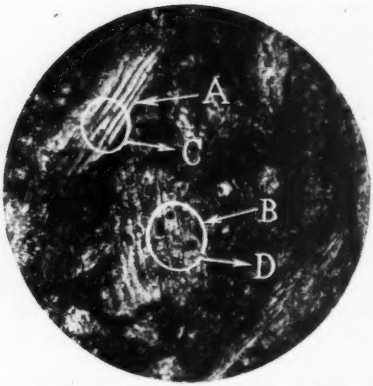

Fig. 295.—Beechwood filled moulding, showing bubbles in vessels. Mag. 100 diameters.

the one marked A has parted under stress, with the result that a long track has appeared along the ray, and although it extends the full length of the particle it has not extended into the surrounding material. The phenomenon can only lead to the conclusion that the gap was generated by shrinkage of the substance of the wood; that is, the vessels have shrunk in themselves, thus pulling the two halves of the particle apart. This can only be so due; because if the fracture was brought about by external stresses, then the strictly limited length of the crack would be difficult to explain.

In view of this, it would appear that failure may be externally originated by the application of stress resulting in rupture occurring external to filler, in addition to which external failure of the particle stricture occurs as a result of shrinkage taking place. As to the actual location of the shrinkage, this point is somewhat obscure, but study of the particle illustrated in Fig. 294 reveals the vessels to be filled with resin, thus producing a structure consisting of rows of cellulose tubes filled with the solid resin, the rows being separated by the thin sheets of medullary-ray cells. It is doubtful whether the resin penetrates and fills

Fig. 296.—Beechwood filled moulding, showing bubble in vessel, at higher magnification. Mag. 515 diameters.

these latter, as they are not in the form of long tubes, as in the case of the vessels.

The shrinkage of the cellulose walls of the vessels or the resin in them, or possibly a combination of both, could conceivably bring about the observed effect; however, there is not sufficient evidence to justify a definite conclusion on this point and for the present the matter must be left as it stands. The

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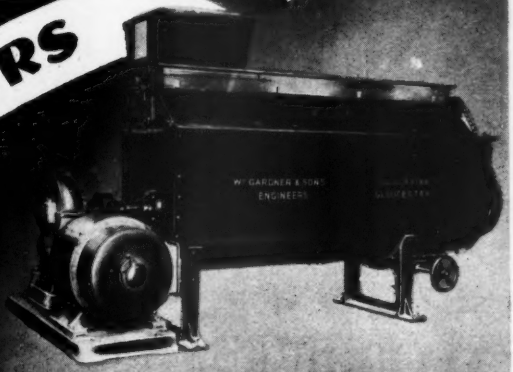

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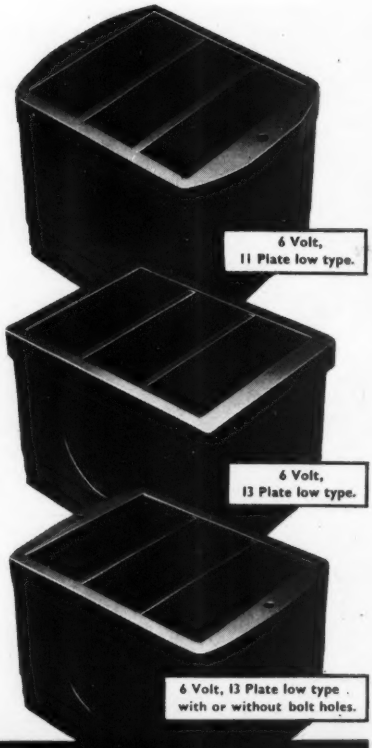

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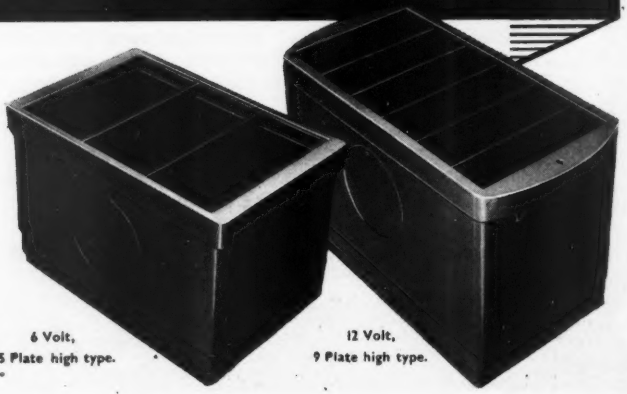

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existence of the two types of fracture is, however, quite definite.

Up to the present we have not discussed the relationship existing between the resin and the filler in this moulding, in so far as the penetration of the resin and its condition are concerned. In the case of the flax shive filler, this was seen to be limited by various influencing factors which occurred fairly generally throughout the texture of the material. In the case of the material now under consideration somewhat similar conditions appear to apply, but not to the same extent as in the flax shive material.

Thus the beechwood particles exhibit the presenee of bubbles in the resin in vessels which are full, rather than exhibiting slight penetration of resin at the ends of the vessels, with an air pocket taking up the remainder of the internal volume of the vessel. In that portion of the section illustrated in Fig. 295, at 100 diameters, two particles A and B show the presence of bubbles in the vessels. The bubbles in particle A are shown in the ring marked C, while those in particle B are at D. Even at this comparatively low magnification the bubbles may be distinguished as being such; at the same time, it is desirable to point out the general granular appearance of the resin.

These bubbles obviously require investigation at higher magnification; the most clearly defined example is that marked D in Fig. 295. Examining this more closely, we see (Fig. 296) this portion of the particle in question at a magnification of 515 diameters. Here it will be noticed that large bubble A has been trapped in the vessel by the resin, although its shape would tend to suggest that there was movement in one direction before immobility occurred. It must be pointed out, however, that this bubble is situated at the point where there is an appreciable and sudden decrease in the diameter of the bore of the vessel. Two other bubbles, B and C, not being thus situated, will be seen to be spherical; from this it may be concluded that the resin almost completely fills the vessels in this particle, and as the bubbles are small it is highly probable that they originate, in the main, from the reaction water.

In view of the pressure employed, one would expect such bubbles to be even smaller, and therefore the possibility of their being trapped air must not be overlooked; if we examine the section marked C, we see a resin mass inside another vessel, which indicates clearly that it contains a great many very small bubbles. This appearance is characteristic of the resin throughout the moulding, and we shall examine this aspect in greater detail subsequently.

(*To be continued*)

THERMOPLASTIC CABLE INSULATION

As an extension to the applications of polyvinyl chloride, already well established as an insulant and sheath for many forms of cable, recent developments in extrusion technique have facilitated the production of thin dielectric walls, which had hitherto presented serious manufacturing problems. In addition, a new process has been developed by which it is possible to attain still thinner walls of 0.006 in. and below. In this, a p.v.c. paste is applied to the conductor in a special applicator, removal of solvent and subsequent gelation taking place as the covered conductor passes through a heating oven.

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It is anticipated that this process will see wide extension into other fields, such as telephone exchange wiring, radio and light current apparatus, where space factor, coupled with stability and freedom from moisture troubles, is important. This trend may be enhanced by the possibility of employing p.v.c. sheaths for use where metal sheaths have formerly been necessary to give adequate protection to the textile insulants employed.

BRITISH RESIN PRODUCTS, LTD.—Dr. J. J. P. Staudinger has been appointed to the board of this company and will occupy the position of director of research.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

B.P. 595,854. Application date: 11.5.45. Convention date (U.S.A.): 30.3.44. Accepted: 18.12.47.

Improvements in the Stabilization of Polymerizable Aromatic Compounds. E. R. Erickson. To: The Mathieson Alkali Work.

Stabilization of polymerizable vinyl aromatic compounds (nuclear halogenated styrene) by a 2, 5-substituted hydroquinone.

B.P. 595,870. Application date: 29.9.44. Accepted: 19.12.47.

Improvements in or relating to Compound Sheet Materials. J. H. McGill and E. Whittaker. To: Imperial Chemical Industries, Ltd.

Relates to the manufacture of bonded sheets from at least two sheets of paper, fabric or the like, cemented together by at least one intermediate layer of a flexible waterproof thermoplastic material (polyvinyl chloride) under simultaneous application of heat and pressure.

B.P. 595,881. Application date: 20.7.45. Accepted: 19.12.47.

The Preparation of new Polymerizable Organic Materials and Polymers thereof. R. Hammond. To: Imperial Chemical Industries, Ltd.

Production of polymerizable materials containing at least two $CH_2 = C<$ groups per molecule by reaching in the presence of a inhibitor, one or more mono acrylic or alpha substituted mono acrylic esters of a dihydric alcohol (methacrylic esters of ethylene glycol) with a dicarboxylic acid or an ester-forming derivative thereof.

B.P. 595,925. Application date: 9.7.45. Convention date (U.S.A.): 15.7.44. Accepted: 23.12.47.

Improvements relating to Coating Compositions and Coated Films. To: British Celanese, Ltd.

Heat-sealing cellulose acetate film coated with a composition comprising a soluble, fusible, cyclized rubber, a wax (paraffin wax), a natural resin or synthetic resin, a plasticizer (acetyl triethyl citrate or dimethoxy-ethyl phthalate) and an anti-oxidant.

B.P. 595,999. Application date: 13.7.45. Convention date (U.S.A.): 16.8.44. Accepted: 24.12.47.

Improvements in Production of Spinnable Vinyl Resin Compositions. R. D. Glenn. To: Carbide and Carbon Chemicals Corporation.

Improving the spinning characteristics of vinyl dispersions in a solvent (acetone) by heating the dispersion at a temperature between 80 degrees C. and 100 degrees C. for a period lasting from 5 mins. to 1 hour under subatmospheric pressure (to minimize evaporation), thereafter conducting the dispersion to a spinning zone heated to a temperature between 30 degrees C. and 55 degrees C.

B.P. 596,005. Application date: 13.7.45. Convention date (U.S.A.): 15.7.44. Accepted: 24.12.47.

Coating of Solid Organic Polymers with Polysilicic Acid Esters. To: E. I. Du Pont De Nemours and Co.

B.P. 596,007. Application date: 13.7.45. Convention date (U.S.A.): 15.7.44. Accepted: 24.12.47.

Improvements in or relating to Resinous Compositions. To: E. I. Du Pont De Nemours and Co.

Treatment of aqueous dispersions of resinous polymers (polyvinylchloride or a vinylchloride-vinylidene chloride copolymer) by transferring it from water to an organic phase by mixing with a liquid organic latent solvent plasticizer and removing water from the system.

B.P. 596,008. Application date: 13.7.45. Accepted: 24.12.47.

Polymerization of 4-Vinylcyclohexene. To: Imperial Chemical Industries, Ltd.

B.P. 596,087. Application date: 18.7.45. Convention date (U.S.A.): 18.7.44. Accepted: 29.12.47.

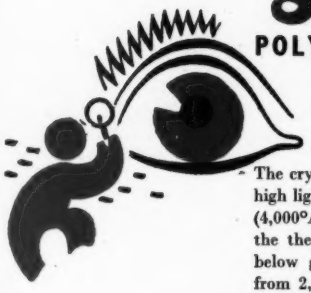
Improvements in or relating to the Manufacture of Modified Polyamides. To: E. I. Du Pont De Nemours and Co.

B.P. 596,108. Application date: 19.7.45. Accepted: 29.12.47.

The Cementing of Polyvinyl Compositions. T. E. Atkinson and B. J. Balfe. To: Imperial Chemical Industries, Ltd.

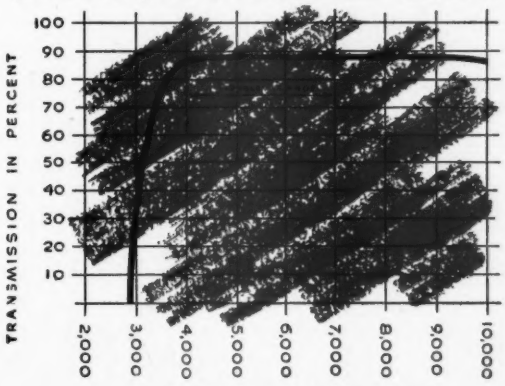
Adhesive solution for uniting a surface of a vinylchloride polymer to the surface of another material miscible with cyclohexanone (polymethyl methacrylate, etc.) or through which cyclohexanone can permeate (wood, leather, etc.), comprising polymethyl

THE OPTICAL PROPERTIES OF MONSANTO Lustron POLYSTYRENE MOULDING CRYSTALS



ensure sparkling transparency, translucence, or opaqueness throughout the entire range of Lustron colours.

The crystal clarity of transparent Lustron is illustrated by its high light transmission, 88 to 90 per cent, in the visible region (4,000°A.—7,000°A.). Because of high refractive index (1.59), the theoretical transmission is only 92 per cent. The chart below gives the light transmission of Lustron in the region from 2,000°A. to 10,000°A. determined on slabs 0.10" thick. An interesting property of Lustron is internal reflection. Parts moulded of Lustron carry light and in effect "pipe" it. This light glows only at edges or at points where the surface is disturbed.



Percent Ultimate Elongation vs. Temperature of Lustron

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methacrylate, acetone or chloroform and cyclohexanone, methylcyclohexanone or tetra-hydropyrane.

B.P. 596,113. Application date: 19.7.45. Accepted: 29.12.47.

Flexible Polymeric Products and Methods of Making same. To: Dow Chemical Co.

Thermoplastic materials having the unusual property of remaining flexible when cooled to −50 degrees C. or even lower, made by forming an aqueous emulsion of a monovinyl aromatic compound, polymerizing same and subsequently adding to the emulsion a conjugated diolefine and continuing the polymerization process.

B.P. 596,186. Application date: 24.6.45. Convention date (France): 7.12.42. Accepted: 30.12.47.

An Improved Process for the Manufacture of Vinyl Chloride. To: Société Anonyme des Manufactures des Glaces et Produits Chimiques St. Gobain.

Manufacture of vinyl chloride from acetyline and hydrochloric acid using mercuric vanadate as catalyst.

B.P. 596,190. Application date: 24.7.45. Convention date (U.S.A.): 10.10.44. Accepted: 30.12.47.

Improved Manufacture of Copolymers and Acceleration of the Cure of Copolymers. R. R. Harris. To: American Cyanamid Co.

B.P. 596,242. Application date: 20.3.45. Convention date (France): 21.7.41. Accepted: 31.12.47.

Improvements in Emulsions of Polyvinyl Resins. To: Société des Usines Chimiques Rhône Poulenc.

Manufacture of polyvinyl emulsions by polymerizing monomeric vinyl compounds in an aqueous medium containing gelatine.

B.P. 596,263. Application date: 25.7.45. Convention date (France): 18.8.42. Accepted: 31.12.47.

Improvements in or relating to the Manufacture of Filaments, Foils and Similar Articles from Polymerized Vinyl Compounds. To: Société Rhodiaceta.

Manufacture of filaments, foils, etc., from vinyl chloride-acetate copolymers by extrusion, followed by a drying operation. Moist acetone is used as a solvent which has the advantage that more concentrated solutions can be used.

B.P. 596,264. Application date: 25.7.45. Convention date (France): 20.4.42. Accepted: 31.12.47.

Improvements in or relating to the Dyeing and Colouring of Artificial Material.

Refers to the dyeing and colouring of cellulose derivatives and polyvinyl resins.

B.P. 596,286. Application date: 21.7.43. Convention date (U.S.A.): 21.7.42. Accepted: 1.1.48.

Improvements in and relating to the Preparation of Synthetic Resinous Reaction Products of Aldehydes and Triazine Derivatives.

To: The British Thomson-Houston Co., Ltd.

B.P. 596,295. Application date: 17.11.44. Convention date (U.S.A.): 19.11.43. Accepted: 1.1.48.

Improvements in Synthetic Rubber-like Materials. C. C. Clark. To: The Mathieson Alkali Works.

Synthetic rubber prepared by copolymerizing dichlorostyrene with butadiene, piperylene or isoprene.

B.P. 596,296. Application date: 17.11.44. Convention date (U.S.A.): 19.11.43. Accepted: 1.1.48.

Improvements in Co-polymeric Materials. C. C. Taylor. To: The Mathieson Alkali Works.

Similar to B.P. 596,295.

B.P. 596,361. Application dates: 4.1.44 and 3.8.44. Accepted: 2.1.48.

Improvements in or relating to the Manufacture of Resinous Condensation Products. B. Frenkel, J. D. Morgan, C. F. Smith and R. W. H. Wicking. To: British Resin Products, Ltd.

Refers to urea formaldehyde resins having improved water and moisture resistance and to the preparation of adhesives which do not crack or craze.

B.P. 596,363. Application date: 15.2.44. Accepted: 2.1.48.

Process for Making Urea Formaldehyde Moulding Composition and Products produced therefrom. L. Smith.

B.P. 596,365. Application date: 11.4.44. Accepted: 2.1.48.

Improvements in and relating to Synthetic Compositions and Products having molecularly Oriented Structure. To: British Thomson-Houston Co., Ltd.

B.P. 596,377. Application date: 10.10.44. Convention date (U.S.A.): 12.10.43. Accepted: 2.1.48.

Improvements in or relating to a Process and Apparatus for the Polymerization of Unsaturated Organic Compounds. To: Bakelite, Ltd.

Multiple-stage process for the bulk polymerization of liquid vinyl monomers or

mixtures of such monomers and of styrene in particular.

B.P. 596,467. Application date: 25.7.45. Accepted: 5.1.48.

The Preparation of New Polymerizable Organic Materials and Polymers and Copolymers thereof. F. J. M. Mackereth. To: Imperial Chemical Industries, Ltd.

Production of polymers containing 2 vinyl groups per molecule, by reacting a chloroformate of an allyl, or an alpha-methyl, beta-methyl, or halogen substituted allyl ester of a hydroxy acid with a dihydric alcohol (ethylene glycol).

B.P. 596,517. Application date: 28.7.45. Accepted: 6.1.48.

Improvements in or relating to Methods of or Means for Attaching Soles to Shoes. To: The British United Shoe Machinery Co., Ltd.

Machine suitable for attaching soles to shoes by means of thermoplastic cements, which are activated by infra-red radiation. Subsequent pressing together is effected by suitable clamping devices.

B.P. 596,564. Application date: 30.7.45. Convention date (U.S.A.): 15.6.44. Accepted: 6.1.48.

Process and Products relating to Rubber-like Copolymers. R. C. Morris, A. V. Snider and E. T. Bishop. To: Shell Development Co.

Production of rubber-like copolymers by copolymerizing a branched chain 1, 3 hexadiene (2-methyl 1, 3-pentadiene and 4-methyl 1, 3-pentadiene) and styrene or alpha methyl styrene.

B.P. 596,579. Application date: 11.10.44. Accepted: 7.1.48.

Improvements in and relating to Method and Apparatus for Forming Bags. To: Marathon Corporation, U.S.A.

Refers to a method and means for the heat-sealing of bags. Open-ended tubes are closed by suitable application of heat and controlled rolling pressure followed by subsequent chilling and setting of the seam under rolling pressure.

B.P. 596,602. Application date: 24.4.45. Accepted: 7.1.48.

Resilient Plastic Material and Process for making it. P. B. Roberts.

Manufacture of a plastic material ("xeroplastic") from lactus juice, adding a coagulant.

B.P. 596,610. Application date: 22.6.45. Convention date (U.S.A.): 7.3.44. Accepted: 7.1.48.

Adhesives. To: International Bitumen Elusions Corporation.

Adhesive composition comprising an aqueous dispersion of bitumen and a water-soluble synthetic resin which sets through the agency of heat, catalysis, etc.

B.P. 596,613. Application date: 17.7.45. Convention Date (U.S.A.): 12.12.44. Accepted: 7.1.48.

Improvements in Manufacture of Organo-Siloxanes. E. L. Warrick. To: Corning Glass Works.

B.P. 596,646. Application date: 6.11.44. Convention date (U.S.A.): 5.11.43. Accepted: 8.1.48.

Improvements in and relating to Adhesive Tapes or Sheets. To: Johnson and Johnson (Gt. Britain), Ltd.

Pressure sensitive adhesive tape or sheet produced by solvent-spreading upon a non-fibrous backing (e.g., regenerated cellulose) an adhesive mass consisting of or mainly containing a condensation product of castor oil with a maleic acid half ester, a film forming plastic (nitrocellulose or ethylcellulose) and in addition a tackifying resin, estergum, etc.

B.P. 596,668. Application date: 10.4.45. Convention date (U.S.A.): 8.6.44. Accepted: 8.1.48.

Process for the Production of Polymeric Di-Alkenyl Silicones. D. E. Adelson and R. G. Larsen. To: Shell Development Co.

B.P. 596,688. Application date: 27.6.45. Accepted: 8.1.48.

Production of Coloured Masses and Articles from Organic Filament-forming Materials. J. L. Moilliet, R. J. W. Reynolds and W. Todd. To: Imperial Chemical Industries, Ltd.

Production of filament-forming linear polyesters in the form of coloured masses or shapes by incorporating with said materials in the molten state a dispersion of a pigment in another linear polyester or polyester-amide and subsequent cooling.

B.P. 596,704. Application date: 27.6.45. (Divided out of B.P. 596,688.) Accepted: 8.1.48.

Production of Coloured Masses and Articles from Organic Filament-forming Materials. J. L. Moilliet, R. J. W. Reynolds and W. Todd. To: Imperial Chemical Industries, Ltd.

Process for colouring polythene by incorporating with polythene in molten form a dispersion of a pigment in a linear polyester or polyester-amide and subsequent cooling.

B.P. 596,716. Application date: 31.7.45. Convention date (U.S.A.): 11.8.44. Accepted: 9.1.48.

Improvements in and relating to Adhesives. W. N. Morris. To: Johnson and Johnson (Gt. Britain), Ltd.

Adhesive composition the adhesive element of which consists of a mixture of synthetic latices containing between 20 and 80 per cent. of chloroprene latex and 80 to 20 per cent. of the latex of a copolymer of butadiene and styrene; it may also contain a thickener (agar-agar) and an anti-bacterial agent.

B.P. 596,750. Application date: 2.8.45. Convention date (U.S.A.): 20.5.44. Accepted: 9.1.48.

Improvements in or relating to the Production of Cured Resin Compositions. To: Imperial Chemical Industries, Ltd.

Copolymerization of a methyl methacrylate/methacrylic acid interpolymer and a partially hydrolized polymer of vinyl acetate.

B.P. 596,800. Application date: 20.3.45. Accepted: 12.1.48.

Improvements relating to the Production of Silicone Alkyl Halides. J. Levi. To: Rotax, Ltd.

B.P. 596,833. Application date: 3.8.45. Convention date (U.S.A.): 10.8.44. Accepted: 12.1.48.

Improvements in or relating to Silicone Compositions. To: Westinghouse Electric International Co.

B.P. 596,858. Application date: 22.9.44. Accepted: 13.1.48.

Improvements in or relating to Process and Apparatus for Forming or Coating Articles by Dipping.

A Communication from Dewey and Almey Chemical Co.

B.P. 596,866. Application date: 29.1.45. Convention date (U.S.A.): 28.12.43. Accepted: 13.1.48.

Improvements in or relating to Moulding Presses. W. Strauss. To: F. J. Stokes Machine Co.

Concerns mainly devices for checking the operation of automatic moulding presses and arrangements to stop the press in case of improper operation.

B.P. 596,943. Application date: 7.8.45. Convention date (U.S.A.): 4.8.44. Accepted: 14.1.48.

Process for the Production of Copolymers containing Chlorotrifluoroethylene and Vinyl Esters. To: E. I. Du Pont De Nemours and Co.

B.P. 596,973. Application date: 14.8.44. Convention date (U.S.A.): 13.8.43. Accepted: 15.1.48.

Improvements in and relating to Adhesive Tapes Suitable for Use in Laminating Materials. To: Johnson and Johnson (Gt. Britain), Ltd.

Adhesive tape suitable for use in laminating materials comprising a flexible fibrous backing impregnated with a solvent sensitizable adhesive including a major proportion of a heat settable resin (phenol-formaldehyde, urea-formaldehyde, melamine, etc.) and a minor proportion of a film-forming material (high viscosity cellulose derivative, polymers of vinyl derivatives, etc.) for increasing the internal strength of the adhesive.

B.P. 597,005. Application date: 8.8.45. Convention date (U.S.A.): 9.8.44. Accepted: 15.1.48.

Improvements in or relating to Polymerization Products of Monoolefines. To: E. I. Du Pont De Nemours and Co.

Relates to the use of oximes as catalysts for the polymerization of ethylene.

B.P. 597,006. Application date: 8.8.45. Convention date (U.S.A.): 8.8.44. Accepted: 15.1.48.

New and Improved Extrusion Apparatus. To: E. I. Du Pont De Nemours and Co.

Covering of extrusion dies with polytetrafluoroethylene or compositions made with Teflon, in order to prevent sticking of thermoplastics to the walls of the extrusion dies. Alternatively a solid die is made from Teflon polymer.

B.P. 597,011. Application date: 8.8.45. Accepted: 15.1.48.

Grommet. A Communication from the Victory Manufacturing Co. (Plastic Res. Eng. Division).

Plastic grommet which can be inserted from one side only of the opening; being expandable it locks itself and prevents displacement. Such grommets have the effect of rivets in holding metal plates together.

B.P. 597,012. Application date: 8.8.45. Accepted: 15.1.48.

Improvements in or relating to Presses in particular for the Manufacture of Bodies from Synthetic Resins and the Like. H. Stüdli.

Multi-cylinder hydraulic press for the moulding of plastics in several stages. All cylinders are supplied with pressure oil from the same source, each cylinder being energized in turn at the right moment.

CELLULOSE ACETATE PLASTICS

(*Continued from page 239*)

position in relation to the main parts of the die, but the shouldered ring, bored to form the outside of the tube, can be adjusted by means of setscrews. Other typical die designs are shown in Fig. 12.

The extruded section is usually taken away from the machine under uniform tension by means of a conveyor belt. Keeping the section to shape, while it is still in a warm and plastic condition, is a problem. This is easily solved, however, for ribbon extrusion by running a balanced contact roller over the piece, thus preventing any slipping of the extruded section. The belt should run at exactly the same speed as the extruded section. The conveyor belt itself is usually made of rubber-covered fabric, although stainless-steel belts are sometimes used. Tubing and similar extrusion can be held in position and cooled by means of air blasts, or even by running through hot water.

(*To be continued.*)

REFERENCES

(1) *Akin, "Modern Plastics," 1946/24/134.* **(2)** *Tennessee Eastman Co., technical literature.* **(3)** *Quoted freely from "Tenite Extrusion," by courtesy of Tennessee Eastman Co., U.S.A.* **(4)** *Modern Plastics Machinery Co., U.S.A., technical literature.*

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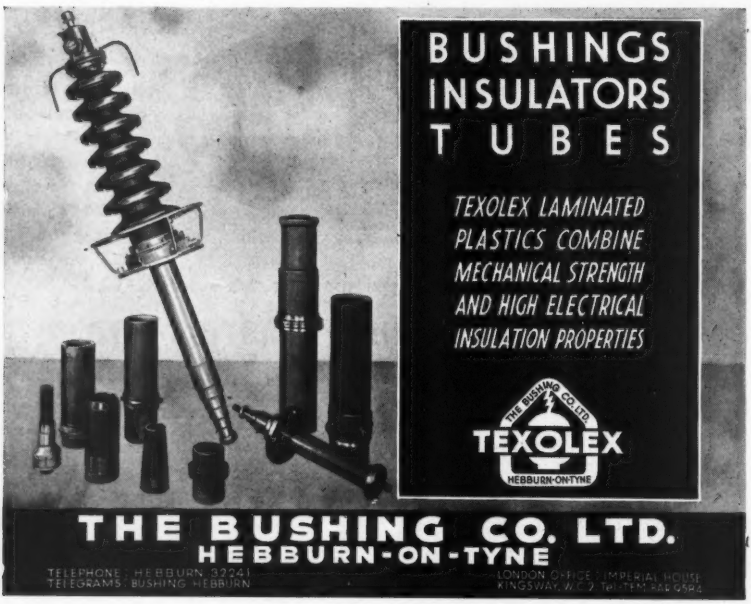

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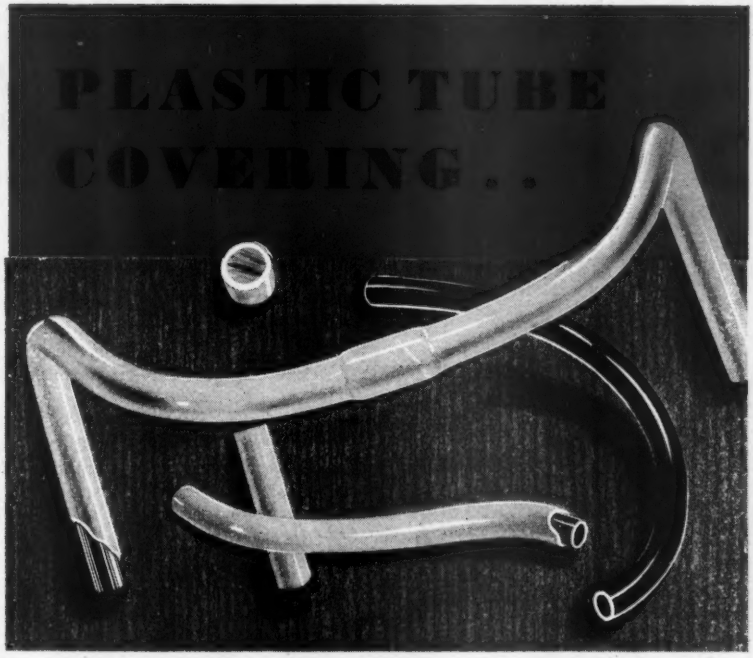

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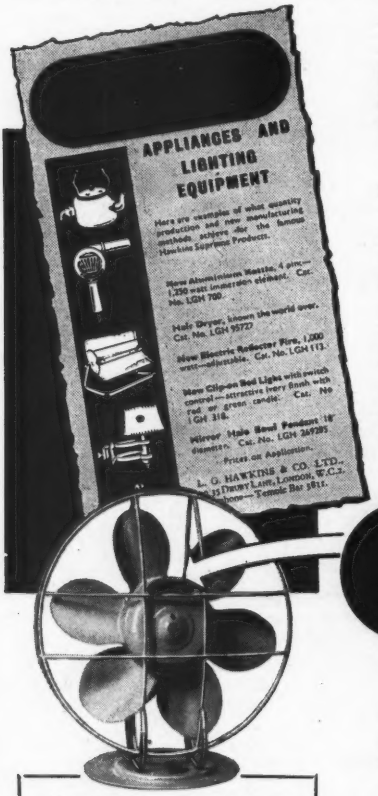

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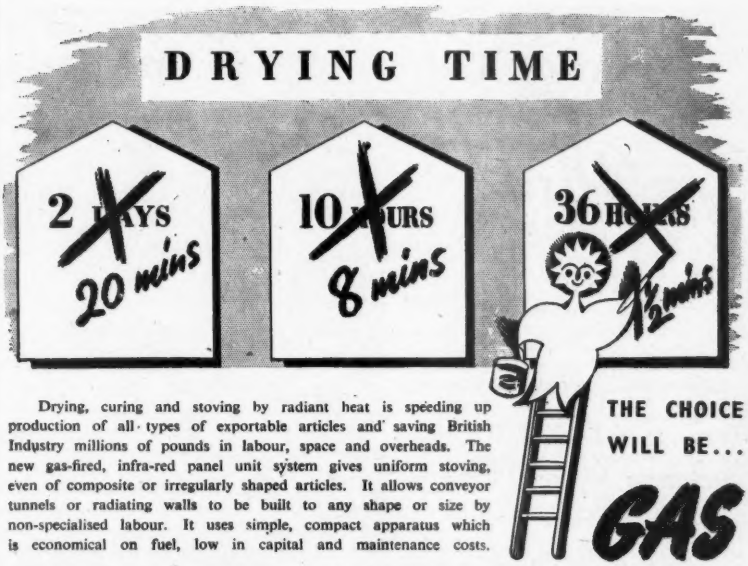

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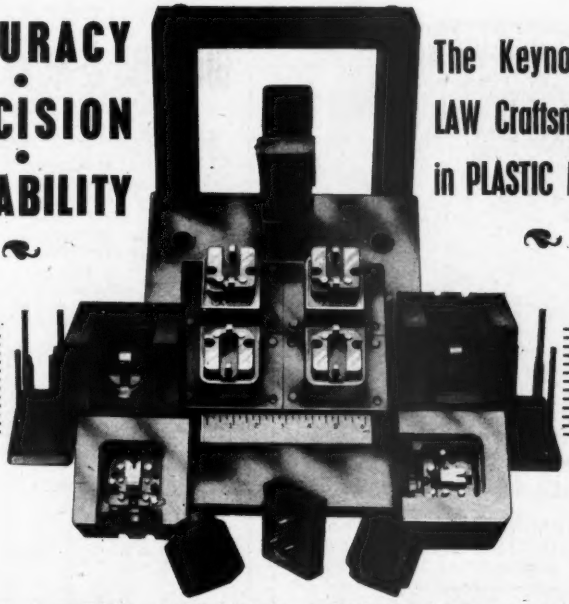

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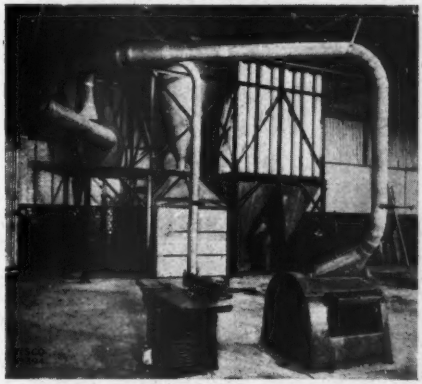

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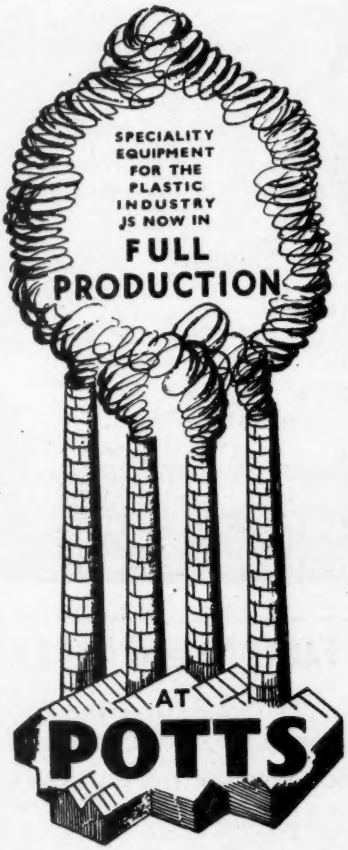

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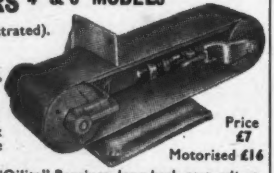

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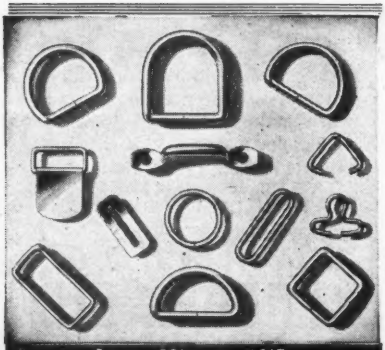

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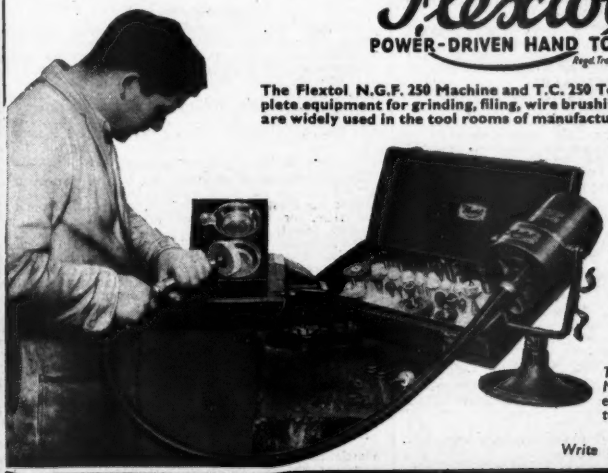

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Pyrometers, calibrated 0-350 degrees C., 3-in. luminous dial, complete with suitable copper constantan thermocouple at 35s. each. Box 3710, care of "Plastics." 132-3

For sale, complete 10 impression moulding tool for heat and light adapators, also complete 12-impression moulding tool for through twiches, together with complete set of tools for metal parts for both tools. Box 3547, care of "Plastics." 132-x7456

We have one only, 70-ton, complete; and one only, 100-ton, complete; self-contained semi-automatic moulding presses, manufactured by John Shaw and Sons, for sale. These presses are new as from makers. Box 3750, care of "Plastics." 133-6442

One P.V.C. chip-cutting machine, comprising one 10-in. by 20-in. Masson rotary cutter with ⅜-in. screen plates, complete with automatic feed, conveyor and magnetic separating equipment, but without electric motors and starters. Can be inspected on application. Box 3828, care of "Plastics." 132-42

For sale. One John Shaw side ram press, 11-in. dia. main (1 ton per sq. in.); two 5¼-in. double-acting side rams, 24-in.-sq. platen area, 30-in. daylight, 12-in. stroke, good condition, working on oil. One Fraser mono radial pump and motor with oil tank, high pressure—1,805 lb. per sq. in. at 1.25 gals. per min, low pressure—200 lb. per sq. in. at 13 gals. per min. (condition new).
Apply: Victor H. Iddon, Ltd., Wythenshawe, Manchester. 133-6440

Shaw hydraulic accumulator, 120 tons, cast iron, weight-loaded type, with three-throw pumps, not AC 415.3.50, latest design as new.
2 Shaw hydraulic presses, 60 tons, 4 columns, platens 3 ft. 6 ins. by 4 ft., daylight 6 ft. 6 ins., as new.
"Ingersoll Rand" horiz. compressor, 100 cub. ft. per min, not AC 415.3.50.
W. Urquhart, 1023-1027 Garratt Lane, S.W.17. Bal 3351. 138-6434

Bandsawing machines (16-in. throat, 9-in. depth cut); spindle moulders (25-in. sq. table); circular saw benches (16 ins. and 18 ins.). Early deliveries: Curtis Engineering Co., 119-121 York Road, London, S.W.11. 134-6439

Machinery, Tools and Plant, Wanted

Wanted, moulding-powder tableting machine. Full details to Box 3181, care of "Plastics." 133-6034
Wanted, one Gorton vertical miller, 8½D or 9J, in first-class condition. Box 3826, care of "Plastics." 132-39

Machinery, Tools and Plant (contd.)

50-500-ton plastic moulding presses required. Write full details to Box 4676, Frost-Smith Advg., 64 Finsbury Pavement, London, E.C.2. 132-20
Urgently wanted, 50-200-ton compression moulding presses. Please forward full details to Richglaze Plastics, Ltd., Upper Bristol Road, Bath. 132-21

PATENTS

Design and patent. The Mardon cigarette box. One-hand operation, new design of levers, no drawer. R. G. Crawley, 16 Bond Street, Trowbridge. 132-x8962

PRODUCTION CAPACITY AVAILABLE AND WANTED

Pulverizing and grading of raw materials, Dohmn, Ltd., 167 Victoria Street, London, S.W.1. zzz-369
Capacity available for plastic work of all descriptions in Perspex, Bakelite, Acetate, P.V.C., etc. Perspex mouldings and manipulation carried out to the highest efficiency in fancy boxes and cartons, all sizes. Box 2847, care of "Plastics." 133-5695
Trianon Electric, Ltd., 95 Cobbold Road, Willesden, N.W.10, produce the best mouldings, designed and manufactured by specialists. Our technical staff is at your disposal and your tools can be serviced by us. 134-x7456
A company with 30 small Bliss power presses and own tool shop is open to undertake the production of stampings in any material. Write Box PD.856, Deacon's Advertising, 36 Leadenhall Street, E.C.3. 134-x8432
Capacity available for laminated Bakelite panels, gears, pinions, bushes, spacers, tubes, tag strips, bobbins and formers, washers, etc.; also machined components in ebonite, keramot and asbestos cement, heat-resisting materials. Box 3746, care of "Plastics." 132-14
We are able to undertake certain short or long runs of highly specialized medical and technical plastic moulded products. Injection, compression or sheet fabrication. Use our services for the preparation of prototypes. All inquiries strictly confidential. Box 7678, care of "Plastics." zzz-422
Injection moulding capacity available on 3-oz injection moulding machine for short and long runs. Box 9035, care of "Plastics." zzz-438
Repetition in Ebonite, Erinoid, etc. Capstan lathe work. Mansell, Temple Street, Rugby. 137-3687
Kingston Plastics, Ltd., Unity Works, Union Street, Kingston-on-Thames, have all the facilities for cleansing, sorting, grinding, kibbling and reprocessing of thermo-plastic materials. Phone, Kingston 8405. 138-4012

Increase sales appeal by colour!
Hand colouring on any plastic smallwares expertly carried out with taste. Long runs only accepted. Send your samples for quotations to Proda (London), Ltd., 17 Bishop's Bridge Road, London, W.2. 139-4972

Capacity available on 40-100-ton compression presses. Tools quoted if not available. Box 2732, care of "Plastics." 132-5702

Australian Plastics Industry.
Director of an Australian injection moulding Company now in England invites inquiries from manufacturers wishing to arrange associations with Australia for powder, machines, purchase or hire of moulds and ideas generally. Ring or write for appointment to, C. N. M. Walker, care of Messrs. Ogden, Hibberd, Bull and Langton, Audrey House, Ely Place, London, E.C.1. 132-5700

Inquiries invited for diecasting tools, press tools and for precision milling and jig boring. Hornflowa, Ltd., Maryport, Cumberland. 132-5696
Good deliveries. Presswork up to 40 tons, tools, fixtures, jigs. All sorts light engineering, commercial plating, galvanizing; also woodwork, assembling, etc.; mass production. Universal Components, Ltd., 19 Sunderland Terrace, Bayswater, W.2. Bayswater 6776 137-6444

Injection moulding specialists have moulding capacity up to 4 oz. Consultants on all injection moulding problems. Please send inquiries to Box 9761, care of "Plastics." 134-45
P.V.C. silk screen printing. Table cloths, curtains, nursery patterns, etc. Capacity available for quantity runs. Quality work. Daily deliveries. Guaranteed adhesion and fastness of colour. Davis (Patents), Ltd., 18 Phipp Street, London, E.C.2. 137-6445
"Impossible" moulding propositions invited by pioneer injection moulders with unusually qualified staff and most modern capacity up to 12 oz. Inquiries in strict confidence and without obligation. Box 1241, care of "Plastics." 132-43
Embossed reproductions of wording and designs on plastics, leathers, showcards, price tickets, and all materials. 24 hours' service. L.I.S.T., Ltd., 69 Fernhead Road, London, W.9. Ladbroke 2507. 134-6437

—RAW MATERIAL AVAILABLE AND WANTED—

Catalin off-cuts and scrapped material for sale. A Kahn, 41 Kennington Lane, S.E.11. 132-x5183

S. R. F. FREED, LTD.,
THE STOCKISTS OF SHEETS, RODS, TUBES, OFF-CUTS AND SCRAP.
OFFER OTHER LINES WHICH CAN BE USED IN COMBINATION WITH PLASTICS.
UTILIZING ANIMAL AND VEGETABLE PRODUCTS.

Such as tortoiseshell, horn, cleaned and prepared cattle bones for industrial purposes, vegetable ivory nuts, porcupine quills, goose and duck feathers, and barrels, etc.

S. R. F. FREED, LTD.,
27b HIGH STREET, SOUTH NORWOOD. S.E.25.
Phones, Livingstone 4042; Sanderstead 2056.
zzz-462

Perspex tubing. We can now supply welded Perspex tubing from ¼ bore upwards. Inquiries invited. Evolite Plastics, Ltd., 325 Latimer Road, W.10. Phone. Lad 1879. 135-5704

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SPECIALISTS IN MANIPULATED AND FABRICATED WORK.
OFFICIAL I.C.I. STOCKISTS FOR PERSPEX.

Have available from stock all thicknesses in clear and colour flat sheet cut to customers' sizes.

Inquiries, prices and particulars upon application to
CLIFT WORKS, BOX, WILTS.
Phone, Box 188.

London Office:
GROSVENOR GARDENS HOUSE, S.W.1.
Phone, Victoria 9182-3.
132-4266

Large quantities of clean polythene white, black and other colours, segregated. Box 2028, care of "Plastics." zzz-202

Perspex, clear and coloured flat sheets, 54 ins. by 48 ins., 48 ins. by 36 ins., or cut sizes. Perspex roof lights to fit corrugated roofing. Flat and corrugated Duralumin and aluminium sheets, 8 ft. by 4 ft., 6ft. by 3 ft., 16-22 gauge. Henry Moat and Son, Ltd., Atom Works, Newcastle. 132-28

P.V.C. strippings from cables, thoroughly cleaned, black, brown, red yellow, blue, etc. Segregated Large quantities 1s. lb.
John Walton and Co. (Castleside), Ltd., Metalex Works, Great Cambridge Road, Enfield. Phone Enfield 3425. zzz-219

ARE YOU LOOKING FOR IDEAL MATERIAL FOR MAKING

Ladies' and children's handbags, shopping bags, knitting bags, beach bags, brief cases, purses, etc.???

WHY NOT TRY "BRITIONA" PLASTIC (P.V.C.) EMBOSSED SHEETING?

30 to 90 thou. in nine attractive colours.

BRITIONA CHEMICALS, LTD.,
MULKERN ROAD WORKS, LONDON, N.19.
Phone, Archway 4014-5. 132-32

Cellulose acetate sheets, transparent, 55-in. by 25 in. by 60-thou., inter-leaved, perfect condition, 8 cwt., 5s. 9d. per lb. Victor Laurence and Co., 10, D'Arblay Street, W.1. Ger 7056-7, 8793. 132-x9280

Tensulam and Bitulac moulding compounds, 25 tons for sale; immediate delivery. Box 3705, care of "Plastics." 132-1

2,000 SHEETS CRYSTAL-CLEAR 30-THOU. ACETATE.
Size 56 ins. by 25 ins.
Weight per sheet 2 lb. 14 ozs.
LOW PRICE FOR COMPLETE CLEARANCE.
ALSO 1 TON 3-MM.
Size 54 ins. by 27 ins. Weight per sheet 7½ lb.
ALLANS,
37 FARRINGDON STREET, LONDON, E.C.4.
Cen 5947. 134-5309

Raw Material Available and Wanted (contd.)

Body for ceramics, floorings, modelling, refractories, etc. Suppliers, Dohm, Ltd., 167 Victoria Street, London, S.W.1. 133-4969

1st quality virgin cellulose acetate moulding powder available. Box 3184, care of "Plastics." zzz-213

Polythene moulding powder (reconstituted) in black, natural and a variety of colours. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-212

Plastic manufacturers, importers of plastic materials !!! Contact us for your requirements of compression moulding powders. Continuous supply in large quantities from prime United States manufacturers. Box 3711, care of "Plastics." 132-4

TRANSPARENT WRAPPING FILM WANTED.
SHEETS 10 INS. BY 8 INS. UPWARDS,
OR REELS 4 INS. UPWARDS.
ANY QUANTITY FOR CASH.
SEND SAMPLE AND DETAILS.
ALLANS,
37 FARRINGDON STREET, E.C.4.
Central 5947. 135-6435

D. H. Ridout and Son, Ltd., Reg. Office, 12 Stedman Road, Southbourne, Bournemouth (Phone, Southbourne 505), offer:—
New Perspex sheets, 72 ins. by 24 ins. by 5-32-in. paper covered, 66s. sheet; 50 ins. by 12 ins. by 5-32-in., 24s. sheet; 23¾ ins. by 17 ins. by 3-16-in., 20s. sheet.
Perspex scrap, crystal and amber, all gauges, good-sized pieces, 1s. 3d. to 2s. lb., according to gauge and quantity required.
Ribbed plastic belting, 1¼-in. wide, green and beige, 6d. per yd.
Plastic panelling, in sheets 96 ins. by 48 ins. by 1-16-in. or ⅛-in., suitable caravans or partitions, from 48s. sheet.
Transparent acetate sheeting, .007-in. thick, 3s. 6d. lb.
Same material, .010-in. thick, 4s. lb.
Opaque tangerine acetate sheets, 48 in. by 21 ins. by 2 mm.
New material, paper-interleaved, 25s. sheet.
Clear emerald acetate sheet, 50 ins. by 20 ins. by ⅛-in., new material, paper-interleaved, 35s. sheet.
Crystal acetate sheets, 2 mm, 3 mm., 4 mm. 5 mm., at 5s. 6d. lb. Discount for quantities.
Plastic door furniture, complete with locks, at keen prices.
Numerous crystal and amber squares, discs, etc., suitable for pocket torches, toys, etc. All new material, 3s. lb. Samples on request.
Plastic screw-top bottle caps for home and export markets. Inquiries invited.
100,000 yards braid for lamp shades, trimmings, etc.
Gold, rose, blue, green, orange and brown. On cards, new material, from 1½d. per yd.
25 Tons coir mattress fibre, from 4d. lb.
10 Tons art silk waste stuffing, 7½d. lb.
Transparent celluloid in crystal, pink, green and blue sheets, 54 ins. by 24 ins. by .015-in. and .020-in., 4s. lb.
Discount for quantities.
2 cwt. black acetate sheets, approx. 58 ins. by 25 ins. by 5 mm., 5s. lb.
All prices ex works. 132-25

Moulding powder, approximately 1 ton standard medium shock-proof heat-resisting black phenol moulding powder for sale, price 2s. lb. or near offer. Box 3713, care of "Plastics." 132-5

Quantity of perspex scrap for sale. Offers wanted. Box 3714, care of "Plastics." 132-6

Wanted. Transparent and white P.V.C. scrap. Offers to Box 3722, care of "Plastics." 132-8

Quantity of plastic rods, tubes and strips for sale. Write Box 3723, care of "Plastics." 132-9

P.V.C. scrap for sale. Inquiries invited. Box 3724, care of "Plastics." 132-10

P.V.C. For sale, clean sheeting cuttings and cable strippings. John Castle and Co., Ltd., 18a Newport Street, Lambeth, S.E.11. 132-40

Perspex. For sale, about 5 tons clean, clear scrap and small offcuts. John Castle and Co., Ltd., 18a Newport Street, Lambeth, S.E.11. 132-41

For sale. One ton of Catalin. Offers invited. Apply Box 3725, care of "Plastics." 132-11

Perspex, all colours, paper covered for sale, ⅛ in. to ½-in., large or small quantities. Waverley Works, Nr. Bicester, Oxon. 132-x8347

Raw Material Available and Wanted (contd.)

Cellulose butyrate, black, approximately 8 tons, 2s. 10d. per lb. or offer. U.P.C., 73 Highgate Road, London, N.W.5. (Gulliver 5466.) 132-23

Erinoid P.V.C. sheets, 17-in. by 21-in. .060-in. thickness, approximately 3,000 sheets black, red and brown, assorted designs. Offers to clear stock will be considered. Write Box 3578, care of "Plastics." 132-x8624

Wanted, thermoplastic moulding powders and moulding scraps, all kinds. Offers and samples to Alfa Plastics, Ltd., 20-21 St. Dunstan's Hill, E.C.3. 132-44

Perspex acrylic sheet. Ensure quick delivery, one of the largest stocks in the country at your service, complete range of colours, 1/16-in. to ½-in., recognized stockholders. J. H. Berry, Plastics, Portland Works, Annesley Woodhouse, Notts. 132-48

For sale, "Transpex" sheets, ¼-in. and 3/16-in.; cellulose acetate rod, ⅜-in.; acetate sheet, 3 mm. clear; P.V.C. strip, 1-in. Box 3363, care of "Plastics." 132-47

Celluloid sheets, tortoise shell, .040 in. (1 mm.) for sale. Box 3405, care of "Plastics." 132-30

I.C.I. "Perspex" acrylic sheeting. Stockists offer all thicknesses and colours, substantial rebate for coloured materials in large quantities. Also I.C.I. crinothene sheeting for lampshades, upholstery, etc. Also polythene powder for sale in opaque colours. Regular supplies. And all other injection moulding powders. Almex, Ltd., 78 Exchange Buildings, Birmingham, 2 (Midland 0682), and Cuprex, Ltd., 120 Moorgate, London, E.C.2 (Metro 9641). zzz-220

Always large stocks of
CASEIN
rods, tubes and sheets.
PERSPEX
sheets up to 1-in thick.
CELLULOSE ACETATE.
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Phone, Clerkenwell 4686. 132-4019

Ebonite and bakelite always in stock. Phone, Archway 3654. A. E. Goodeve, Ltd., 188a Seven Sisters Road, London, N.7 139-4965

Metal powders and oxides. Quotations and samples on application. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-410

Scrap. Why not let a well-established firm quote you for cellulose acetate, polystyrene, P.V.C. cuttings and other thermoplastic off-cuts and scrap? Having best use for these materials, highest prices can be paid. Quotations on receipt of representative samples to M. H. Grist (Plastics), Ltd., 82-84 Brighton Road, Surbiton, Surrey. Phone, Elmbridge 4214. zzz-457

Wanted, plastic waste and plastic piece goods. Send particulars, stating quantity and price. Box 2382, care of "Plastics." zzz-468

Polythene cable strippings, moulding scrap and foil urgently required, state amount available and send small sample. Box 3186, care of "Plastics." zzz-217

Buna-plast, a blending of synthetic rubber and P.V.C. specially processed for manufacturing leather substitute; this material is far superior to plasticized P.V.C., inquiries welcomed. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-216

P.V.C. calendering compound in a range of opaque colours. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-215

Polystyrene moulding scrap urgently required, state amount available and send small sample. Box 3185, care of "Plastics." zzz-214

Polythene powder for sale, in opaque pastel colours—regular supplies. And all other injection moulding powders. Almex, Ltd., 78 Exchange Buildings, Birmingham, 2. Midland 0682. 132-35

Regular supplies of imported celluloid in sheets, tubes and rods. H. J. Alter, 51 Seymour Street, W.1. Phone, Paddington 3137. zzz-221

Regular supplies of Durez phenolic powders and Durez resins for all industries. H. J. Alter, 51 Seymour Street, W.1. Phone, Paddington 3137. zzz-222

Perspex, 76 sheets 48 ins. by 48 ins. by ⅛ in., eight sheets 60 ins. by 48 ins. and 17 sheets 48 ins. by 36 ins. by 3-16 in. clear, 77 sheets 42 ins. by 42 ins. by ⅛ in. opal. Surplus to requirements. Georama, Ltd., Swanley, Kent. 132-x9383

SITUATIONS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50, inclusive, or a woman between the ages of 18 and 40, inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1947, or the vacancy is for employment excepted from the provisions of that Order.

Laboratory assistant required for research work dealing with new plastic material developments; applicants should not exceed 20 years and should have intermediate B.Sc., experience in plastics an advantage but not essential. British Nationality, good references. Please write Box 3214, care of "Plastics." 134-3040

A progressive company in the Midlands manufacturing plastic materials requires the services of qualified engineers and mechanical and electrical draughtsmen; applicants for the engineering appointments should be at least of Higher National Certificate standard, all applicants should have some experience of mechanical or chemical plant layout and design, the vacancies offer ample opportunities. Applications, stating previous experience, positions held and academic qualifications, should be sent to Box 3196, care of "Plastics." 132-6033

AN OPPORTUNITY WILL SHORTLY OCCUR FOR A FIRST-CLASS SALES MANAGER TO ASSIST THE DEVELOPMENT OF A PROMINENT PLASTIC ORGANIZATION OPERATING IN BRAZIL.

The successful applicant should be of good education, under 40 years of age, have a sound experience of commercial practice, a knowledge of Spanish and Portuguese, and be capable of organizing the entire Sales Department of a progressive concern.
The business has close association with a prominent British undertaking, and the successful applicant will also act as liaison between Great Britain and South America as far as raw material supplies are concerned. Knowledge of the plastics industry is an advantage but not a necessity if the applicant has the other attributes mentioned in this advertisement.
Apply in the first instance to Box 3824, care of "Plastics." 132-38

Laboratory assistant required for research work on new plastic material developments; applicants should not exceed 18 and must be of British Nationality, experience in plastics an advantage but not essential, good references. Please send particulars of education, etc., to Box 3215, care of "Plastics." 134-3041

Chemist, physical chemist or physicist required for research laboratory engaged in new plastic material development; applicants should have B.Sc., be of British Nationality and not above 25 years, good references essential, salary according to age, qualifications and experience. Please apply Box 3213, care of "Plastics." 134-3039

LAMINATED PLASTICS.
A VACANCY OCCURS FOR A FIRST-CLASS SALESMAN WITH KNOWLEDGE OF THE LAMINATED PLASTICS INDUSTRY.

Successful applicant should be under 40, of pleasant personality, good education and appearance, and be prepared to give his whole endeavours to further his job. The vacant position carries a good commencing salary and the opportunity for promotion to a managerial position. The job also carries a superannuation scheme. The man wanted must be capable of a big job and can develop his position quickly by his own endeavours.

Apply to
SALES DIRECTOR,
DE LA RUE INSTALLATION, LTD.,
IMPERIAL HOUSE,
84-86 REGENT STREET, LONDON, W.1.

132-36

Wanted, production manager for new plastic factory in Bombay, must possess sound practical experience in cable production. Apply Box 3151, care of "Plastics." 132-x7207

Plastics company in West Midlands requires shop manager, experienced in the extruding of P.V.C., preferably with knowledge of chemistry, as applied to P.V.C. Please state experience, age and salary required. Write Box 3749, care of "Plastics." 132-16

Situations Vacant (contd.)

PLASTIC EXTRUSIONS.

A GENTLEMAN WITH KNOWLEDGE OF THE PLASTIC EXTRUSIONS INDUSTRY IS REQUIRED ON THE SALES DEPARTMENT OF A PROGRESSIVE COMPANY OPERATING IN THIS FIELD.

The successful applicant will command a good commencing salary and have opportunity to prove his ability for promotion to an executive position.
The job requires pleasant personality, good education and appearance, and the gift of enthusiasm for the work in hand. This is an excellent opportunity for a hard worker with an intimate knowledge of the Extrusions industry.

Apply to
SALES DIRECTOR,
DE LA RUE INSTALLATION, LTD.,
IMPERIAL HOUSE,
84-86 REGENT STREET, LONDON, W.1.
132-37

Injection moulding shop foreman required, excellent prospects for man with practical experience. Write stating age, experience and salary required to Box 3748, care of "Plastics." 132-15

Courtaulds, Ltd., requires an experienced moulding technician to take charge of a bakelite moulding unit in Coventry. Applicants should be between 35 and 45 years of age and should have full practical knowledge of thermo plastic and thermo setting materials. Consideration will be given only to men fully experienced in high precision industrial moulding and who are used to control of labour. Applicants should write for a detailed questionnaire to the Director of Personnel, Courtaulds, Ltd., 16 St. Martins-le-Grand, London, E.C.1., quoting the reference No. P.B.31. 132-19

Agents and representatives for London, West Country, Midlands, North of England, Scotland and Northern Ireland. Engineering and/or laminated plastics experience an advantage. Adequate remuneration and prospects (on co-operative basis) assured to suitable men. Box 3741, care of "Plastics." 132-13

Representative required with knowledge of cellulose acetate, polystyrene and P.V.C. Ex-Service man with good record preferred. Applications giving age and references to Box 3740, care of "Plastics." 132-12

Empire. Urgently wanted for the development of new industries in tropical British Colony capable young man (single) with pioneer spirit. Essential good knowledge of natural resins and oils used in paint industries, also chemistry, engineering or botanical qualifications an asset. Guaranteed trial period and contract with excellent prospects for right man. Box 3715, care of "Plastics." 132-7

Graduate organic chemist age 25-35 years, required in Yorkshire, preferably with practical experience in the production of synthetic resins and similar materials. Knowledge of physical chemistry an advantage but not essential. Salary according to age and qualifications, superannuation scheme in operation. Replies to Box 3825, care of "Plastics." 133-6441

Manager required for a progressive and expanding business in Birmingham. Products include insulating material in plastic mouldings, mica and micanite. Primary considerations are personality and sound administrative ability, with technical qualifications, and works experience. Remuneration would be related to results. Applications, giving age, experience and an indication of present earnings to Box 3406, care of "Plastics." 132-33

Situations Vacant (contd.)

Young man required for development laboratory having University Degree in Chemistry or Physics or equivalent qualification with practical experience in rubber or related field of work. Salary according to qualifications or experience. Minimum £450 per annum plus cost-of-living bonus. Apply, Technical Director, B.B. Chemical Co., Ltd., Leicester. 132-34

Chief chemist. Manufacturers of brake linings require qualified chemist for production and experimental work. Previous experience of friction materials not essential but must have practical experience in textile impregnation and resin manufacture. Original thought and initiative sought. Pleasant district, also pension scheme. First-class salary to man of wide experience. Hubert H. P. Trist and Co., "Top-Dog" Works, Bristol, 4. 134-6438

Bakelite Limited require a technical assistant to work in the Darlington area on production problems, preferably with chemical engineering qualifications; a chemist with engineering experience or engineer with chemical knowledge will be considered. The nature of the work will be to investigate alternative manufacturing methods for plastic materials leading to improved plant design and arrangements. Reply to: Bakelite Limited, Tyseley, Birmingham, giving details of age, experience, qualifications and salary required. 133-6436

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Factory time recorders. Service rental. Phone, Hop 2239. Time Recorder Supply and Maintenance Co., 157-159 Borough High Street, S.E.1. 137-3686

MISCELLANEOUS

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Packing Cases for Export, etc. Full service, prompt deliveries. F. Rawle and Co., Ltd., 71 Kensington Avenue, London, E.12. Phone, Grangewood 2003. 132-4010

Monomarks. Permanent London address. Letters redirected, 5s. p.a. Write, Monomarks, BCM/MONO76, W.C.1. 134-5313

Plastic cement for use with Perspex Acrylic sheets. Grade I, available in large or small quantities, clear and coloured. Trade inquiries from Evolite Plastics, Ltd., 325 Latimer Road, London, W.10. Phone, Lad 1879. 1138-04011

One-gallon tins, new, bottles and containers for all trades. If you have any difficulty with your container supplies contact Box 2702, care of "Plastics." 132-x5798

Engraved name plates, scales, dials, etc., supplied. Tickets and Co., Box 2, Silver Street, Leicester. 141-5699

Extend Your Trade.
Use a Trade Mark. Consult
Trade Mark Protection Society,
12 Church Street, Liverpool. 142-6036

Huts, Nissen-type, 24 ft. span and 16 ft. span, any length; also other industrial buildings, suitable for workshops, stores, garages, canteens, site office, club halls, etc., no acquisition licence required. Write, phone or call for details. J. Thorn and Sons, Ltd., Box 138, Brampton Road, Bexleyheath, Kent. Phone, Bexleyheath 305. zzz-204

Wood chips and sanded powder for plastics boards available at Staples and Co., Ltd., Cricklewood, N.W.2. 132-18

TOOLMAKERS & DESIGNS (Coventry) LTD.

BRAYS LANE, COVENTRY. Telephone: COVENTRY 4051/2.

TOOLMAKERS TO THE ENGINEERING AND PLASTICS INDUSTRIES

The foundation of success in mouldings rests on first-quality Moulds. Our reputation ensures first-class returns to our clients. Repeat orders prove it! We design and manufacture compression-transfer-injection moulds of highest quality and finish. Jigs, fixtures, gauges, press tools, special-purpose machines, etc. Limited capacity also available for high-class batch production work.

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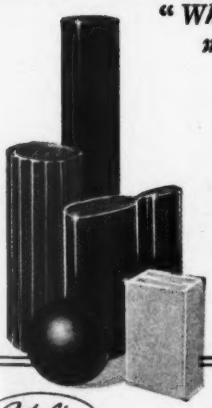

" Which, like the toad, ugly and venomous, wears yet a precious jewel in its head."

(As you like it)

Fable once had it that in the head of the toad was to be found a precious stone. To-day we know better. Its existence in industry is not fiction but established fact. For Catalin is that gem . . . a thermosetting cast phenolic resin of unsurpassed beauty of colour, form, and style, transforming the practical things of to-day, making possible the wonders of to-morrow.

CATALIN is supplied in rods, sheets, tubes, and special profile sections: a wide range of glorious colours and mottles, opaques, translucents, and transparents: is free-working: easily machined: has good physical properties: odourless: tasteless: Non-inflammable: resistant to alcohol, most acids, and micro-organisms.

CATALIN

THE GEM OF MODERN INDUSTRY

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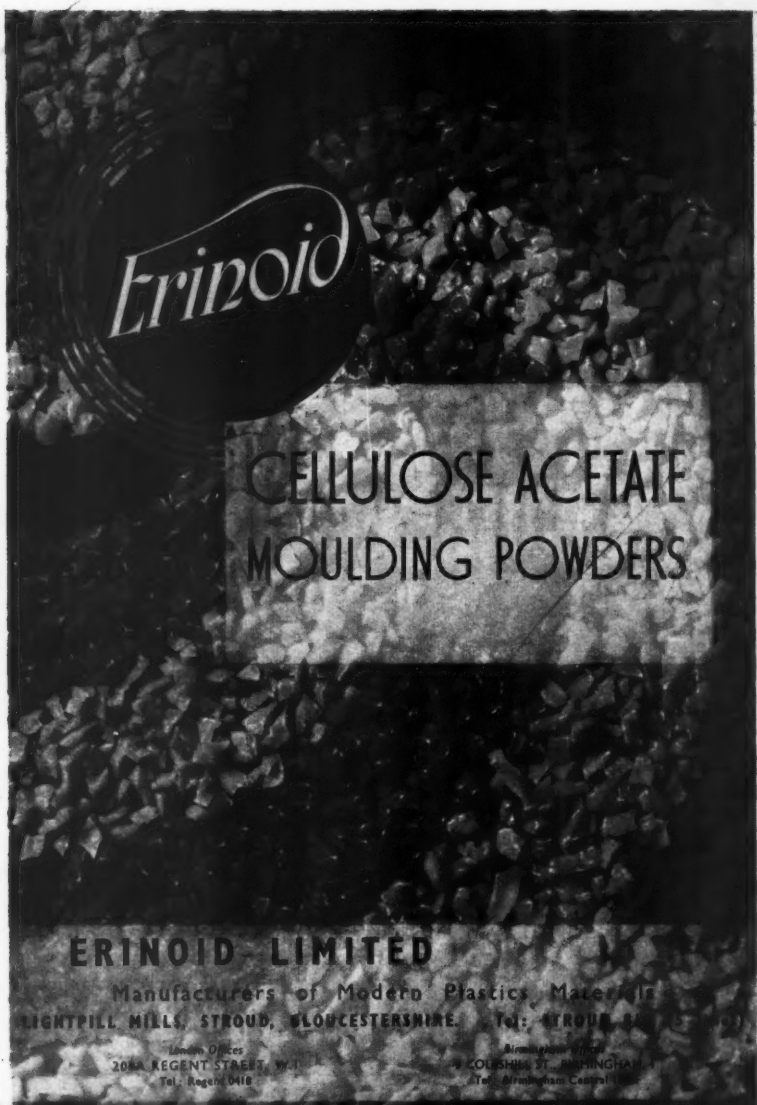
CATALIN LTD. WALTHAM ABBEY ESSEX *Telephone: Waltham Cross 3344*

MAY, 1948. Vol. XII. No. 132 **Plastics** TWO SHILLINGS



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